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EUROPE & LATIN AMERICA

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NETHERLANDS: JOINT RESEARCH IN CERAMICS, CATALYSTS

Rijswijk PT/AKTUEEL in Dutch 15 Apr 87 p 3

[Text] A Ceramics and Catalyst Research Center (CKKO) will be established at the University of Twente whereby the Energy Research Center of the Netherlands (ECN) and the University will jointly conduct research in the field of Technical Ceramics and Catalysts. The CKKO will be part of the chemical engineering department of the university. The ECN will provide an annex within the UT in which initially three ECN staff members will be housed to work closely with the UT personnel.

The scope of work of CKKO will be drawn up jointly by the university and the ECN. The purpose is to stimulate the cooperation between the experts of both institutions, resulting in an effective interaction between basic research at UT and development work at ECN. Within this framework CKKO will, among other things, contribute to the educational system provided by the department. Paid projects will also be carried out for industries and institutions interested in the production and application of advanced ceramics.

The ceramics research is initially aimed at achieving an optimum composition of the powdery raw materials for the manufacture of high-quality ceramic end products. The goal is to produce materials that, at high temperatures, exhibit desirable mechanical properties such as toughness, strength and resistance to wear. The program is a continuation of the current ECN and UT research programs and is also a basis for further expansion of the activities.

The goals of the many-faceted catalyst research are mainly directed at the development of porous ceramic materials that can serve as a carrier for catalysts in industrial processes. In order to achieve an optimum effectiveness of catalysts, a large effective surface area is required, placing very high requirements on the porosity and design of the carrier material. Possible applications are in the area of fuel cells, catalytic (flameless) combustion of natural gas and the removal of nitrogen oxides from flue- or exhaust-gases.

For the establishment of the CKKO, the Ministry of Education and Sciences granted a subsidy of 50,000 guilders. The personnel expenses and a part of the development expenditures will be born by ECN, while the University of Twente will make the use of the laboratory and other personnel accommodations available.

13326/12859
CSO: 3698/443

SWEDEN: KTH, ASEA, STU STUDY SUPERCONDUCTIVITY APPLICATIONS

Stockholm NY TEKNIK in Swedish 16 Apr 87 pp 16-17

[Article by Carl Daniel Norenberg: "KTH Enters the Temperature Chase"]

[Excerpts] The Institute of Technology (KTH) in Stockholm is now seriously going to start research on superconductive materials. By means of a new device for surface modification of materials, Professor Rao, in the department of solid state physics, is going to work on producing practical, usable materials that are superconductive at as high temperatures as possible.

Superconductivity, which means that the electrical resistivity disappears at extremely low temperatures, has become a "hot" research area during the last six months. It began with researchers at IBM's research laboratory in Zurich finding a metal oxide with a high critical temperature (See NT 1987:10). That is to say a temperature where the superconducting characteristics begin. Lately, researchers from around the world have reported higher and higher critical temperatures.

"We must place KTH on the map among those research centers that are in the forefront when it comes to developing new applications within the materials technology. Otherwise we cannot attract the best researchers in the world and have to be content with following the development from the sidelines."

Professor Rao was previously active as a professor in the United States and has worked in Sweden every now and then. Thanks to his broad international contact network and his extrovert "American" disposition, Rao has, in only two years, built up an enthusiastic international research group at the physics institute. He has also initiated cooperation with ASEA, on the industrial side, as well as with STU (the National Board for Technological Development), primarily aimed at practical applications of the new technology.

Rapidly Solidifying Superconductors

On the initiative of Director Gunnar Brodin and others, Professor Rao has received resources from the Wallenberg Fund for the purchase of new equipment, part of which is a device for surface modification of materials. With its help, for instance, it would be possible to coat a matrix material with prac-

tically any kind of surface material and then modify it as needed. In this manner a superconductive surface could be created on a circuit board.

The equipment, which is the most up-to-date of its kind, cost about 1.6 million kronor to buy.

"The new superconductors, made from yttrium-barium-lanthanum-copper oxide, are actually a kind of ceramics," says Professor Rao.

"Their properties can be insulators in one configuration, in another magnetic conductors. In order to produce new, interesting material combinations from basically immiscible materials, various techniques for rapid solidification are used. The faster the solidification can be accomplished, the larger the possibilities are for varying the structures in the possible material combinations. Within STU's basic project "Rapidly Solidifying Materials", therefore, a cooperation is under way with, among others, the Institute for Metal Research (see NT 1986:44). Today they have managed to reach 10^{-12} degrees C/second. The product is a band or a thread which can then be sintered to larger bodies.

Rapid Development

The latest temperature limit, where tendencies towards superconductivity can be demonstrated in a material, is 240 K or -33.15 degrees C and is reported by Professor Constantin Politis at the Nuclear Research Center in Karlsruhe.

The same man is also responsible for the most recent highest measurement for "true" superconductivity, i.e. where the material shows a sharp lowering of resistivity at a certain temperature, in this case 105 K (-168.15 degrees C). Several reasearchers have likened the importance of these results to the discovery of electricity.

"It is still not understood what mechanisms govern the superconductive behavior; there are five different theories at the present time," says Professor Rao.

"On the other hand, understanding is not needed for developing practically functioning materials. That is why we are in the process of building up resources for the new technology. As of today, we can already measure the Hall effect, magnetic elongation, electric resistivity, as well as high-energy magnetism at KTH. Research into superconductivity is also conducted at the Chalmers Institute in Goteborg.

12339
CSO:3698/464

NORWAY: SCANDIUM FOR JOINT EUROPEAN SUPERCONDUCTIVITY STUDY

Oslo AFTENPOSTEN in Norwegian 7 May 87 p 4

[Article by Rolf L. Larsen]

[Text] Trondheim--"Western European countries will work together to develop the best possible 'recipe' for superconductors and applications for them. A superconductor is a new material that can conduct electricity without resistance. Superconductors will revolutionize our day-to-day work in technology. Yesterday NTH (Norwegian Institute of Technology) decided to begin a study to see if an extremely expensive and rare Norwegian metal--scandium--could be used in superconductors."

"Most Western European countries will now begin to work together to increase their knowledge of superconductors and to develop this type of technology. In this way, we will begin to compete with the United States and Japan in the hope of reaching the goal first," Professor Kristian Fossheim of the Institute of Applied Physics at NTH told AFTENPOSTEN.

Last Tuesday Fossheim participated in a meeting in Brussels at which Western European researchers and scientists developed a strategy for cooperation. The largest American and Japanese research institutes have now closed their doors, locking in both information and researchers who are working with superconductors.

"At the meeting in Brussels we summed up Western European knowledge in this area and developed the program for a larger meeting in Genoa, Italy, in early July. About 350 Western European scientists, researchers, and engineers from agencies and industry in the Western European countries will meet there to share their experience in superconductor research," Fossheim said.

Norwegian Representative

The Trondheim professor was the only Norwegian representative at the meeting in Brussels, in which about 20 Western European experts in the field participated. The meeting was sponsored by the European Commission.

New Materials

Superconductor research is taking a greater and greater share of EC investments in the development of new materials that can be used in new technology. In this country, too, several research groups in Trondheim are working together in this specialized field. The Institute of Applied Physics will work together with the Institute of Inorganic Chemistry and the Electronics Laboratory (ELAB) to help Norway build up its own expertise in this extremely interesting specialized field.

During the past few months the Norwegian Scientific and Technical Research Council, Elkem, and Statoil have contributed funds for superconductor research in Norway.

"Both the research councils and the industry are extremely positive, so that we will be well equipped for this task," Fossheim said.

Superconductors

For this reason, NTH is also interested in answering the industry's current questions, such as what superconductors can be used for and which elements can be used. One metallic element that was named last week is the metal scandium. It is an extremely expensive element that could possibly be used in lasers and superconductors.

"We decided today to begin a research program to answer these questions. We will now purchase 10 g scandium. This element is about twice as expensive as gold and these few grams will cost about 12,000 kroner. The results will be available this summer," Fossheim said.

A major seminar will be held this fall for Norwegian research institutes, agencies, and the industry to sum up Norwegian expertise in superconductor technology and to chart the course for future Norwegian research in this field.

9336
CSO: 3698/446

CHIRAC URGES PRIVATE FINANCING OF SPACE ACTIVITIES

Paris LE MONDE in French 15-16 Feb 87 p 6

[Article by Jean-Francois Augereau]

[Text] Toulouse--The weather was overcast, and the trade unions at the Toulouse Space Center, concerned about their future, were waiting for Jacques Chirac in the rain. However, that did not slow down the pace of the trip which the prime minister made to Toulouse on 13 February, visiting the installations of the National Space Studies Center (CNES).

He spent 15 minutes here, 10 minutes there, had his picture taken with the future French astronauts and Claudie Deshays, their pretty representative, visited a center for the control of satellites, and met with a few technicians and officers. Lost in the long text of a speech which he gave were a few short phrases which led us to think that the CNES might well face some changes. Referring to the commercial and industrial aspects of French space policy, Jacques Chirac recalled that it would be necessary "to make the best use of existing capabilities" on the projects now under way or to be undertaken in the future, such as Ariane 5, Hermes, and Columbus. (1) (The Europeans are considering developing heavy Ariane launch vehicle, which could place in orbit commercial satellites or the Hermes space aircraft, with which it would be possible to service the Columbus manned space module, an integral part of the future, permanent American space station.)

The prime minister said that the Helios military reconnaissance satellite program "should benefit from the achievements of the CNES in the observation of Earth." In the same way the Hermes manned space aircraft should make use of the capabilities and resources of the Ministry of Defense. While praising our space industry, Jacques Chirac emphasized that the CNES "should make its remarkable knowledge of space problems available to those who need it," that is, to the satellite users, "without, however, trying to substitute for them."

All of that seems to work in favor "of organizational measures" which the government will approve "in the near future," and which will be "adopted to ensure the optimum effectiveness of all of those working in these areas." The prime minister considered that only under these conditions "will the civilian sector be able to control the growth of its future costs and rely in part on

private initiative. These space activities will not reach maturity until they have ceased to rely solely on public financing."

Preserving the Independence of France

Certainly, programs such as the Ariane 5 and the Hermes, whose total cost cannot be much less than 40 to 60 billion francs, do not seem to be threatened. However, the message is clear for the rest of the space projects, including all of those affected by direct satellite television broadcasting. Prime Minister Chirac said that the state has done its duty for TDF [the first French direct television broadcasting satellite], which will be launched by Ariane before the end of 1987. However, he recalled, those concerned with TDF-2 should assume responsibility for it, because the state "will not take their place in this private financing sector."

These views also suggest that the CNES, over the longer term, may see control over programs with some prospects of profitability taken away from it, to the benefit of industrial concerns, such as the programs concerning the future SPOT civilian reconnaissance satellites. Finally, it may be asked whether some of these statements do not refer to the conclusions of the recent report prepared by Philippe Sahut d'Izarn, regarding the establishment of a holding company which would group together the commercial activities of the CNES.

Whatever the case, the time is coming for decisions to be made, with the programs for the future Ariane 5 heavy launch vehicle, the Hermes, and the Columbus soon reaching the point of decision. The Europeans should commit themselves to develop these programs, following the forthcoming, ministerial level space conference. The time for decision is also coming up for the Kourou space launching site (in French Guiana), which needs new equipment. In this connection Prime Minister Chirac stated that security measures had been taken "to ensure its integrity and tranquility." Finally, we should not forget the forthcoming launch of an Ariane rocket, which should take place in June and on which this entire policy rests if we want France, as well as Europe, to maintain its independence in the space area.

5170
CSO: 3698/293

A-320 CONSIDERED SUPERSTAR IN PARIS, A-340 LAUNCHED

Duesseldorf HANDELSBLATT in German 11 Jun 87 p 19

[Text] Paris, 10 Jun (AFP)--There are 1,454 exhibitors from 31 countries at the 37th International Aerospace Exhibition from 11 to 21 June in Le Bourget, north of Paris. Around 200 airplanes will be shown, a number of them during flying demonstrations, including the most recent Airbus model, the A-320, which is being considered this year's "superstar." It is expected that there will be 350,000 spectators. The exhibit area has been enlarged by 10,000 square meters, making the total area 78,500 square meters.

The public will be allowed in only on a total of 5 days--on the weekends--the rest of the time being reserved for professionals in the field. The host, head of the French government Jacques Chirac, will give a speech on the space industry after a dinner with French and foreign personalities on 20 June.

Besides the Airbus A-320, the chief attractions of the show include the prototypes of modern combat airplanes, the French "Rafale," the British "EAP" and the American B1-B strategic bomber. A great deal of attention will probably be given as well to a scale model of the European "Hermes" space shuttle. More than 220 exhibitors from the United States have registered. However, Boeing, the biggest producer of civilian aircraft, will not be presenting a single airplane during the exhibition in Le Bourget, which will be officially opened by French President Francois Mitterrand at 1:00 pm on Thursday. The German aerospace industry and research community is represented by a large joint stand of 37 companies, including Dornier GmbH of Munich, which introduced a new turboprop airplane last month, and Messerschmidt-Boelkow-Blohm GmbH (MBB), which is similarly planning the MPC-75 jet for regional air traffic. China, which participated in the last aerospace exhibition in Le Bourget 2 years ago, is showing military aircraft this time.

The "superstar" of this year's aerospace exhibition, which was held for the first time in 1905, is considered to be the "small," 150-seat Airbus A-320, whose virgin flight took place last February and for which there are already 277 orders and 177 buying options one year before it is due to go into service.

The A-320 has a range of 3,500 to 5,950 km. The steering movements by the pilot are transmitted from the cockpit to the control surfaces electrically,

instead of hydraulically (fly-by-wire control). Directly at the ailerons in the wings as well as at the flippers and vertical rudders in the stern, the electric impulses are then relayed to the appropriate hydraulic system. This system was introduced in part in the Concorde supersonic passenger airplane, but signal transmission in the newest Airbus model takes place not directly, but rather by way of a computer system.

The simple command issued by the pilot using a sidestick located next to his seat is in this way transformed into an entire series of extremely complex and rapid commands that permit the best possible flight position. The computers make it impossible for control over the machine to be lost by constantly checking whether the issued commands are consistent with the respective attitude of the machine and with its reserve capacity. Before the machine is stalled, the computer system initiates an increase in thrust or a change in attitude. Five computers and three independent circuits are intended to avert any failures. Because of the same safety considerations, the software for the computers was commissioned out to two different study groups. For emergencies, especially during landing, the pilot retains a mechanical system. There were initially objections by pilots to "total computerization," since they did not want to give up their place to a computer. The new Airbus is being tested in Toulouse with a specially developed rangefinder that reduces the length of the test flight by 25 percent. Under consideration are the French-American M-56-5 engines and (beginning in 1989) the V2500 by the International Aero Engines (IAE) consortium.

The first customers are to be Air-France and British Caledonian, who will each receive one A-320 in April 1988. At Lufthansa, this model is to gradually replace the Boeing 727 beginning in 1989; it has submitted 15 firm orders and assumed options for 15 more.

The biggest airplane manufacturer in the world announced in mid-February that with its Boeing 737-400 and its future 7J7 (beginning in 1992), it would remain in "effective" competition with the A-320, which it called a good machine. Boeing said that it has been convinced for 10 years that the European Airbus consortium is subsidized, but that it does not intend to officially lodge a complaint. In addition, McDonnell-Douglas and its trijet MD11, which is to replace the DC-10, is reportedly more seriously affected by competition from the future European medium- and long-range Airbus A-320 and A-340.

The latter program was officially presented by the European consortium Airbus Industrie last Friday in Paris. The decision was made possible when the governments of the four countries involved in the project--the FRG, France, Great Britain and Spain--specified their subsidies for the expansion of the Airbus program. Ten airlines have thus far expressed an intention to buy or interest in around 130 machines in the new series. The pertinent ministers of the four governments plan to meet Friday in Le Bourget. There they will give the official go-ahead on the expansion of the range of offerings, for which subsidies totalling $3.1 billion have already been promised.

12271
CSO: 3698/519

ARIANE PROBLEMS DELAY SCANDINAVIAN TELE-X

Stockholm NY TEKNIK in Swedish 16 Apr 87 p 6

[Article by Sven-Olof Carlsson: "New Problems For Ariane"]

[Text] Paris--The engine in the third-stage booster rocket of the Ariane spacecraft is still not functioning satisfactorily. Therefore Ariane will not be ready for launch in April as planned, nor in June which was the next launch date. At this time, Arianespace does not even venture to give a time for the go-ahead.

According to the French technicians, it was the ignition in the third-stage booster rocket that went wrong at the failed launch in May last year. This has now been fixed. During test-firings, however, other technical problems have been found, among them, the fuel-pumps are overheating.

It is not clear whether it is simply mechanical problems or whether there are electrical problems as well, and finding the faults can take time.

The third-stage rocket engine, with its fuel of liquid hydrogen and oxygen, is an advanced and difficult to handle propulsion technology, which is also found in the main engine of the American space shuttle. It is so advanced and interesting that it led to the espionage that was recently revealed within the space organization, ESA (the European Space Administration), and which led to three Soviet diplomats being expelled from France.

Further Reconstruction

Arianespace is figuring on the need for further reconstruction of the third stage. The latest calculations show that it will cost at least one billion kronor for these new improvements of the technology.

The engine problems are considerable in many ways for Arianespace and ESA. Since the activity of the American space shuttle is at a standstill and will remain that way for another year, Ariane had the opportunity to get several interesting customers. But then we have the new problems....

It is conceivable that several possible customers may turn instead to China which can offer its Long March. Or perhaps to Japan, but its rockets, so far,

have demonstrated poor lift-off capacity. India's latest rocket launch was also a failure. And the one-time rockets in the United States, type Atlas and Delta, are used, when they function, for American military satellite launches.

If Ariane takes too much time, it may even delay the Scandinavian Tele-X long enough that there will literally be nothing to launch. There are so many other opportunities for TV-transmission by satellite within the Scandinavian countries that a very delayed Tele-X might have to be postponed forever. It is also not at the top of Ariane's waiting-list.

12339
CSO:3698/464

NETHERLANDS FOKKER SEES 5 'TOUGH' YEARS BEFORE BREAKTHROUGH

Rotterdam NRC HANDELSBLAD in Dutch 5 May 87 p 13

[Article by NRC HANDELSBLAD staffer F. M. Bicker Caarten: "Next 5 Years Tough for Fokker"]

[Text] Amsterdam, 5 May--N.V. Koninklijke Nederlandse Vliegtuigfabrieken Fokker, which presented its annual report yesterday, appears to have tough years ahead.

This is evident first of all from the fact that the company will not issue any new stock, as it had planned to do. When a company changes its mind about that, it usually means just one thing: that the bankers who will have to dispose of the stock do not believe they can sell it. Investors do not have enough confidence in Fokker, given last year's results.

Fokker itself says the same thing, somewhat more diplomatically: "Fokker's results (in 1986) did not justify the issuance," R. C. Van den Heuvel, a member of the board of directors, said yesterday. The market's lack of confidence is obvious just from the violent fluctuations in the price of Fokker stock over the past year. Or, in Van den Heuvel's words, "It is first necessary to restore more stability to the price of Fokker stock so that current and future stockholders will not be put at a disadvantage with the issuance of new stock."

Since Fokker will not get any money from investors, it will borrow, up to a maximum of 500 million guilders, from commercial banks. Do the banks have sufficient confidence in Fokker to lend it that money? Of course, because lending involves fewer risks than purchasing and then selling stock, which after all is risk capital.

Fokker will not reveal details about the loan but it will certainly be considerably more expensive than issuing stock. If Fokker borrows the full amount, it will have to pay at least 25 million guilders a year in interest. That is more than last year's profit of 19 million guilders. This morning Van den Heuvel replied to a question on this point as follows: "That interest is not an additional expense. It will be added to the price calculations." In other words, the price of Fokker's aircraft will go up just a bit to keep the

company profitable.

To keep going Fokker will have to sell aircraft, because that is practically the firm's only activity. Out of sales of 1,403 million guilders, 1,146 million came from aircraft construction. But, Fokker says, in the next few years its aircraft will not earn it a cent. Development costs have to be paid back first. Fokker will not say when it will reach the break-even point but an analyst said that Fokker will have to sell 200 each of the F-100 and F-50. With current production capacity of 60-72 aircraft a year, a rough calculation indicates that Fokker cannot look forward to profits from aircraft construction for 5 1/2 to 6 years. In the meantime where is the money going to come from to keep the company going? Fokker's other activities --space, defense equipment, a small piece of the Airbus-- are much too inadequate. When asked, Van den Heuvel said the same thing: "Diversification is certainly no remedy if the aircraft program starts to do less well."

Finally there is the danger about which President F. Swarttouw himself warned, the cheap dollar. Fokker is protecting itself against exchange rate fluctuations in every way it can, Van den Heuvel says, but "if the currency stays undervalued, that calls for hedging, taking a large loss at once. And as a private company Fokker cannot afford that."

12593
CSO: 3698/448

AIRBUS MILITARY APPLICATIONS: AEW, TACAMO, SIGINT, CASEVAC

Subsidy Billions Still Needed

Munich INDUSTRIEMAGAZIN in German Jun 87 pp 82-88

[Text] Airbus. The passing of the buck concerning the expensive European passenger airplane continues. While Strauss and Bangemann are fighting over state and private-sector plans for ownership and financing, strategists at the parent company for Airbus in Germany, MBB, are giving thought to an entirely different direction: they want to make the civilian aircraft fit for military service.

Franz Josef Strauss made it clear once again who the senior mentor of the German aviation industry is: Franz Josef Strauss.

He was scarcely subtle in asserting in a threatening letter that his counterpart in Airbus matters in the Federal Ministry for Economics, Martin Bangemann of the FDP, has no idea of the importance of the multibillion-mark project.

As early as during the coalition negotiations in February, the Bavarian minister president brought all his political influence to bear in order to ensure the future of his favorite project, Airbus. Strauss stood up not only as the father of his people, but also as a directly affected interested party: He is the chairman of the board of directors of Airbus Industrie in Toulouse, as well as the representative of Bavaria as a stockholder in the parent company to Airbus in Germany, MBB AG in Munich; Bavaria's share in the company is 25 percent.

Strauss was apodictic during the coalition negotiations in expressing his expectation that the new federal government "work on a revision of the outline of Airbus serial financing and create the corresponding budgetary requirements for it."

In order to emphasize his goals, Strauss pushed for "man with my confidence" in the key political role for coordinating aerospace policy. Thus, the old parliamentary state secretary in the Federal Ministry for Economics, Martin Gruener (FDP) had to make room for Strauss confidant Dr Erich Riedl (CSU).

Chancellor Helmut Kohl, his Minister of Finance Gerhard Stoltenberg and FDP Minister for Economics Martin Bangemann acquiesced because they wanted to put Strauss in a good mood in this matter close to his heart. Their objection, noted for the record, that this contradicts the government's intention to dismantle subsidies was acknowledged by Strauss; nonetheless, he regards the aviation industry as the archetypal exception to the rule.

Strauss knows that neither the first two models, the A 300 and A 310 (medium-range airplanes), nor the A 320 short-range jet will make it in the foreseeable future without financial assistance from the state, to say nothing of the long-range aircraft planned for the 1990s, the A 330 and A 340.

It was with all the more consternation that the head of the CSU reacted when he learned of a letter from Bangemann to MBB management chief Dr Hanns Arnt Vogels, dated 11 March--exactly the day the coalition was finally sealed through the election of the chancellor.

In that letter, Bangemann retracted a great deal of that which Strauss had regarded as having been settled in the coalition agreements. Specifically, the minister for economics wrote that he sees "no possibility" of supporting the A 330 and A 340 long-range airplanes beyond the promised developmental expenditures of DM 2.4 billion. "Serial financing," the Liberal minister said bluntly "must be assumed by industry."

But that was not all. Bangemann also demands that MBB carry out drastic economy measures. In the production of the A 300/310, the German airplane manufacturer is to reduce costs by DM 392 million by 1994, with a reduction in the A 320 (rollout was on 14 February) of as much as DM 434 million.

It was precisely about this total figure of DM 826 million that MBB chief Vogels lodged a complaint in Bonn, since Deutsche Airbus GmbH (which has a 37.9 percent interest in the European airplane consortium; see the figure on page 86 [not included]) cannot make it with the subsidies already promised, due to the lag in sales and the intensified price war by the leader of the world market, Boeing.

At the latest after reading this combination of numbers, Strauss realized that contrary to his own impression, he had apparently run into a dead end during the coalition negotiations. There are still two completely opposite plans for the organization of the German aviation industry. While the Liberal Bangemann is striving for a primarily private-sector arrangement, which the state helps along only during the development phase for new products, Strauss sees the future of Airbus as being assured only under the protection of government spending--as is the case with the Airbus partners in France, Great Britain and Spain.

Through his letter to Vogels, the minister for economics clearly presented his idea to his adversary Strauss: If MBB effects the requested reduction in costs, then the federal government will assume the so-called old debts amounting to DM 3.1 billion (guaranties for the serial production of the A 300/310).

Bangemann would like to put the financial burden, which can hardly be estimated for the future, on other shoulders. According to his plan, MBB should be fortified into a financially powerful company through the participation of strong partners from the private sector, thus becoming a company that is able to support the immensely expensive Airbus program on its own.

The most desirable partners in Bangemann's "industrial solution" are first of all Daimler-Benz, MBB's neighbor in Munich BMW and the financially strong electronics companies Bosch and Siemens.

Bangemann is a professional optimist. When he mentioned in passing the idea of participation to Daimler head Prof Werner Breitschwerdt last year, he interpreted the shaking of the latter's head as a firm commitment by Daimler-Benz, the principal stockholder in Dornier.

That fact that Bosch indirectly has a 4.39 percent investment in MBB and that Siemens recently increased its indirect holdings to 9.32 percent is interpreted by the minister for economics as a sure sign of their interest in increasing their investments.

However, when MBB executive Vogels and his two deputies, Sepp Hort and Roland Micklinger, put Daimler-Benz to the acid test at the Liberal minister's prompting, Bangemann's bubble was burst. At a meeting in Munich on 3 April attended by Daimler board members Edzard Reuter (Finance), Heinz Duerr (for AEG-Technik) and Johann Schaeffler (Dornier), Reuter categorically refused joint financial responsibility for Airbus. The Daimler treasurer: "We have become wealthy because we have not in the past invested in losing properties."

No wonder that in reaction to Bangemann's letter, Strauss fired off his own letter to Bonn: "The substance of your plan disappointed me profoundly, but it does show that on the one hand the dimension of the Airbus program and on the other hand the possibilities of the German industries supporting it continue to be incorrectly assessed."

No wonder as well that MBB would like most of all to transfer its subsidiary Deutsche Airbus GmbH, in which it has a 100 percent interest, over to the state. Because without massive public assistance with a long-term guarantee, the Munich aerospace company (with a sales figure of DM 5.6 billion) is threatened by suffocation under the burden of the financing requirements of the Airbus program. The subsidiary is responsible for the first MBB loss ever, for fiscal year 1986. The DM 135 million deficit (against a profit of DM 109 million in the previous year) resulted exclusively from the assumption of interest charges, amounting to DM 150 million, from Deutsche Airbus GmbH, which is not consolidated in the MBB balance sheet. Prospects for this year are no better.

Consequently, MBB blames the bad situation on Bangemann's refusal to make up for this from the state treasury, as had been done in the past.

If Strauss is unable to have his way in Bonn, then the catastrophe is pre-programmed. It is already possible to predict at this point that by 1994 a

financial requirement of DM 6.3 billion will pile up to the account of the German Airbus partner for the A 300/310 alone. Even if the federal government, as Bangemann has suggested, assumes the DM 3.1 billion debt guaranteed by it, the rest would be a hard lump for MBB to swallow.

Because the MBB executives must count on struggling for some time to come with a lack of clear plan for Airbus, they are desperately looking around for a source of relief. To their thinking, financial leeway could be provided by a broader spectrum of applications for the aircraft.

In a secret, internal study dated 13 March 1987, they examined "the improvement of basic economic conditions for the Airbus program by exploiting Airbus know-how for military missions." In this study, they list potential deployment roles for which the European civilian aircraft could be well-suited:

--VIP transport: These airplanes have good communications equipment. The level of luxury in furnishings varies according to the status of the persons to be transported.

--CASEVAC (Casualty Evacuation) and Aeromedical Service: This category deals with transporting injured persons to hospitals and with transport including in-flight intensive care for injured persons.

--Weather Aircraft and Photo-Reconnaissance: The equipment on this aircraft includes gear for recording and analyzing sources of radiation with wavelengths in the visible, infrared and ultraviolet ranges.

--Tanker: Tanker aircraft have additional internal and/or external tanks for refuelling airplanes and helicopters in-flight. One or more airplanes could be refuelled simultaneously under the supervision of a special operator.

--Chaff Layer: The primary function of this aircraft is to disrupt enemy radar equipment. To this end, they carry with them a large quantity of reflecting material which is cut apart on-board by special machines and can be scattered across large geographical areas.

--AEW (Airborne Early Warning): Besides early reconnaissance of air targets, AEW airplanes can also provide information on ground targets. In addition, deployment information can be conveyed to other command units, and flight formations can be guided.

--TACAMO (Take Charge and Move Out): In a nuclear confrontation, the aircraft works for the U.S. Navy in maintaining radio and data links between the U.S. National Military Command and the strategic submarine fleet armed with ballistic missiles.

--SIGINT (Signal Intelligence): The airplane's equipment serves to record and analyze all of the electromagnetic transmissions in the radio and radar frequency range.

--Stand of Jammer: The jammer aircraft remains in an area outside the range of enemy weapons. The jamming equipment is largely of an active nature and is directed towards enemy radar equipment.

The authors of the MBB study conclude: "The potential offered by the entire Airbus family in systematic planning for future military applications is of great strategic importance for the FRG and Europe. Aside from the financial relief that would be gained from the civilian and military use of these airplanes, neither the FRG nor Europe can afford to ignore this potential without adequately examining it in terms of practical application."

The operational plans coming from Munich are based on American models. Thus, the MBB strategists point out that their main competitor, Boeing, takes military requirements into account as early as in the design stage of nearly all its models. In this way, the American airplane manufacturer reportedly assures itself of development subsidies from the Department of Defense and of an additional market in the military domain.

The early involvement of military interests in civilian aviation planning has in the past been an alien concept to Europeans. "In this situation it is understandable," the MBB study reports, "that no carrier-based aircraft have thus far emerged from the Airbus family, since no constructive provisions have been made for military requirements of the airplane system."

The MBB planners demonstrate the level of potential for the Airbus that has gone unexploited by pointing to the existing stock of this type of aircraft. The value of this potential in NATO (excluding military transporters and VIP craft) is in the range of DM 18 billion. It can thus be assumed, they say, that the business offensive with a "militarized form of the Airbus" could make a greater contribution to overall financing than the supposed detailed efficiency reserves--a clear side-swipe against the economy measures ordered by Bangemann.

And in an April 1987 memorandum, MBB director Hort entreats his stockholders and board members to assume a firm position against Bangemann's maneuvers. Emphatically he points out that the federal government has in the past continually overtaxed the international competitiveness of the aviation industry and even forced MBB to take over the destitute VFW in Bremen.

With pleasure he quotes in this regard from the letter from Bangemann's predecessor Otto Graf Lambsdorff to the Bavarian minister of finance and chairman of the board of MBB, Max Streibl, dated 4 July 1980: "Only after the merger has been ensured by binding declarations by all involved parties will the federal government be able to make the necessary decisions on the Airbus program."

If Bangemann were to now go after "national competition" instead of international competitiveness in this exceedingly cost-intensive branch of industry, Hort continues, new capacities would be developed while the existing ones would disintegrate through reduced production potential.

Strauss's deputy Erich Riedl is to now provide flank protection in Bangemann's ministry--as coordinator for the aerospace industry. The first important task for the newcomer is to revise the fourth "Report on the Situation of the Aerospace Industry," written by his predecessor, Gruener; although this report was acknowledged by the cabinet in June 1986, it was rejected at the instigation of Strauss. "Gruener IV" (cabinet jargon) will become "Riedl I" this fall. It is already clear where Strauss's confidant will leave "his mark": A concentration of the German aerospace industry including Dornier and with state assistance.

In view of the gigantic sums of money and the overpowering U.S. competition, scarcely any other solution is conceivable--despite all the ideals of free enterprise. "Since the politicians have once and for all decided in favor of the Airbus program," MBB head Vogels says, "they cannot now saddle private companies with the consequences."

The alternative to Strauss's national aviation company would be withdrawal from the Airbus consortium.

Military Uses Considered

Bonn DIE WELT in German 23 May 87 p 9

[Article by Wilhelm Furler: "Defense on Board"]

[Text] There is no turning back. The spiral of subsidies for the prestigious European Airbus project is spinning on. In the past few days, London and Paris have made definitive financial promises (DM 1.35 and 1.9 billion, respectively) for the development of the two new Airbus models, the A 330 and the A 340. It thus comes as no surprise that Bonn has promised an "appropriate" investment of DM 2.9 billion in the development of the two new Airbus models.

Despite justified reservations, this fundamental decision was made all the easier for the cabinet under the leadership of Chancellor Kohl by the fact that the Airbus program will in the future be viewed to an even greater extent as the sole opportunity for close technological cooperation in Europe. Airbus aircraft have earned an outstanding reputation not only among airlines, but also with the competition.

It is not feasible to think that Boeing, number one on the world market, will abandon the markets for the promising medium- and long-range aircraft. The trijet medium- to long-range model, the A 330, and in particular the four-jet A 340 are intended to put an end to the Americans' monopoly, which no one (neither the airlines nor the taxpayers) can feel very good about.

Nevertheless, there remains an enormous problem. It is true that the federal government is to assume a large part of the development costs for the new Airbus generation, and that it will be involved in reducing the old debts from the A 300 and A 310 programs; the figure being discussed is DM 1.9 billion. However, there remains a gap of around DM two billion between these promises

and the (according to State Secretary Riedl "justified") request for DM seven billion from MBB, the 100 percent parent company of Deutsche Airbus GmbH.

As could hardly be otherwise expected, Franz Josef Strauss, the chairman of the board of the European controlling establishment Airbus Industrie, apparently received from Ministers Stoltenberg and Bangemann during the high-level meeting no promises whatsoever for federal government involvement in future serial production of the A 330 and A 340. How then should MBB bear this burden? The subsidiary Deutsche Airbus--with a 37.9 percent interest in the European aircraft consortium--has already been responsible for the first MBB loss ever, in fiscal year 1986. The DM 135 million deficit (against a profit of DM 109 million in the previous year) resulted exclusively from the assumption of interest charges, amounting to DM 150 million, from Deutsche Airbus GmbH. Prospects for this year are no better.

The regularly recurring demand by the federal minister for economics that MBB--of which a 52 percent interest is, after all, in the hands of the Laender--should check into participation by powerful German companies such as Daimler-Benz (with Dornier, MTU and AEG), BMW, Bosch or Siemens, is too naive. Although Bosch and Siemens already have an interest in MBB of 4.4 and 9.3 percent, respectively, the suspicion suggests itself here that Bangemann wishes to put the financial burden, which can hardly be estimated for the future, on other shoulders. He is at any rate attempting to impress upon the companies that the gain in image by displaying national responsibility justifies relinquishment of a short-term "return on investment." Daimler treasurer Edzard Reuter views this differently: "We have become wealthy because we have not in the past invested in losing properties."

This is not to say that there is not in principle any interest among industry in investing in Airbus. However, there is scarcely any with the current Airbus strategy. This could be one explanation for why consideration is now being loudly (at least more loudly than before) given to the military deployment possibilities of the Airbus models. This would open up an undreamed-of additional development and production potential in areas of high technology.

Such a program revaluation would be meaningful in other regards as well. The Americans, who do not miss an opportunity to complain about subsidies to their main competition, Airbus, subsidize their civilian aircraft indirectly through financial assistance for parallel military developments. One example of this is the AWACS early warning system, which is based on the Boeing 707.

If use were made of the military potential of the Airbus family, the American accusations concerning subsidies would be rendered untenable. The not particularly good experiences that Airbus has had thus far on the American market can be attributed largely to these accusations. And that market is of life-or-death importance for Airbus.

12271
CSO: 3698/518

BRIEFS

SWEDISH LAW ON SPACE ACTIVITY--The Swedish Space Movement, which gathered some 60 people in Stockholm last Saturday in a demonstration for space, is demanding that the law prohibiting Swedes from engaging in space activities be abolished. According to a Swedish law from 1982, Swedish citizens are not allowed to carry on space activities in Sweden or in any other country. The Space Movement maintains that the law lacks motivation. Sweden ought to take the space technology seriously. The Swedish Space Movement was founded in 1984 and today has a membership of 500-600, according to its spokesman, Hans Starlife. [Text] [Stockholm NY TEKNIK in Swedish 16 Apr 87 p 2] 12339

FRG REPORTS KOREAN SATELLITE LAUNCH PLAN--The Korean Institute for Space Studies and Astronomy has drawn up a plan for the government in Seoul according to which the country will by 1996 be in a position to launch satellites weighing a total of up to a half a ton, using Korean-developed rockets. The country's space program will be under the leadership of the Ministry for Science and Technology. After several test satellites, the Korean space program will be clearly oriented towards telecommunications and television transmission satellites. In concrete terms, work on the project in the coming year is to be supported by a budget of two to three billion won. In subsequent years, this figure is to be increased each year by 50 percent. At the same time, various Korean universitites are to undertake cooperative ties with research facilities in Great Britain, France and the FRG in relevant fields. There is no doubt in this sense that South Korea is unable to start its own space program without foreign technical assistance. Still, the first Korean satellite, planned for 1996, should have a Korean interest of more than 50 percent, according to explicit statements coming from Seoul. The location of the Korean launch facility has yet to be decided on. Work is to be begun on a large-scale Korean satellite ground station as quickly as possible. The completion of this ground station is planned for 1991. [Text] [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 27 May 87 p 8] 12271

CSO: 3698/519

FRENCH INDUSTRY MINISTER ON BIOTECH POLICY

Paris BIOFUTUR in French Mar 87 pp 7-8

[Interview with Alain Madelin, minister of industry, postal services, telecommunications, and tourism: "Toward a Policy of Innovation: Decentralization and Cooperation between Research and Industry"; date and place not given; first paragraph is BIOFUTUR introduction]

[Text] BIOFUTUR [BIO] asked Alain Madelin [AM], minister of industry, postal services, telecommunications, and tourism, four questions about the government's position on biotechnology. We are pleased to bring his replies to our readers.

BIO: What is your position on the importance of biotechnology for industry and for small- and medium-sized firms (PME's) in particular? Do you view biotechnology as having a high priority in France's technology policy?

AM: Biotechnology is both the oldest activity in the world and the most modern. It is the oldest because fermentation or plant and animal selection were at the origin of man's food and nourishment. It is the most modern because scientific discoveries of the past few decades or years make it possible to apply elementary life processes to practical ends. New activities have emerged engendering new engineering disciplines in genetics, the biomedical and enzyme fields, immunology, microbiology, and cytology.

A new industrial revolution is in the offing, analogous in its impact on industry and society to the now well-known information technology revolution.

The revolution which pharmaceuticals has already undergone gives some idea: a multitude of new products, new production processes, new research methods, etc. Other sectors of activity have begun to be transformed by the use of biotechnology techniques (agriculture, food processing, chemicals, materials, energy, pollution technology, etc.); the influence will be even greater in the future.

This is therefore indispensable technology. French R&D must affirm and improve its position in the worldwide sharing of this technology.

Biotechnology is technology whose effects reach far and wide. It is of vital interest not only to firms in "leading-edge" sectors like pharmaceuticals, specialty chemicals, etc. but also to firms in the more traditional sectors such as the food industry. There is also a major role for PME's specializing in specific niches because biotechnology generates thousands of products.

BIO: What do you think of the measures to encourage the development of biotechnology?

AM: We find ourselves with a growing industry where there are both tremendous potential requirements and also the steady and spectacular advance of scientific knowledge. Between the two, there are enterprises whose role is to innovate, i.e., to design, to produce, and to sell new products and processes derived from biotechnology. To do that, they must be able to keep their finger simultaneously on both the pulse of the market and on that of science.

It is in this process that the government's role as a catalyst is to be found, while keeping in mind that biotechnology embodies various technologies and forms. The government's role cannot be a direct one--as it is in the aerospace, nuclear, and telecommunications fields--but must be limited to fostering optimum interaction between the partners of innovation. This is a new challenge for French technology policy, which has shown its strength with centralized government programs and which now must learn to show that it can also operate in a decentralized technological environment which brings together both advanced technology industries and more traditional industries--large firms and small.

Among the measures which I consider as high priority let me mention, in line with the program I outlined at the Bertin company on 15 January, the following:

- development of basic research, which does not come under my authority but which is a matter to which I attach great importance;
- cross-fertilization between industry and laboratory through two-way mobility of personnel and through financial and tax incentives for cooperative research projects;
- generation of start-up venture capital to create entrepreneurial companies like the many to be found in the United States;
- protection of industrial property through the revision of patent law;
- industrial security to control the potentially harmful effects of genetic manipulation, protect against major risks and against rejection;
- greater economic freedom for pharmaceutical firms;
- strengthened European cooperation.

All of this has already begun with the Mobilization Program. But we must go further because the stakes are vital. Biotechnology is the very symbol of the innovation policy that I want to implement--decentralization, placing confidence in those directly involved, encouraging partnerships between science and industry.

BIO: What do you think about the large government grants to industry in the United States and Japan?

AM: I am familiar with the BIOFUTUR study on public funding of American, Japanese, and French bioindustry R&D. The study is an interesting one. It shows that the United States and Japan--considered models of liberalism--give much more direct support to bioindustry R&D than is the case in France.

I should like to make two points. First, let me point out how difficult this task was. Even with good input data and a good information network, it is not easy to sum it all up when the financial support is so diverse--operating, investment, and cash credits, program authorizations, direct and indirect assistance, etc.

The second point is that if the figures are viewed on a per capita basis, then probably only Japan makes a relatively greater effort than France and the United States. It is true, however, that the United States is substantially ahead in the total amount of assistance. (Footnote) (Editor's note: The minister is right to point out that the task was difficult and delicate. It is true that government aid to industries investing in biotechnology carries different names, is granted according to variable criteria, and has different uses. It is also true, however, that the total of these sums of money is the actual--stunning and stupefying--figure of the aid granted and that, we understood, the total seemed to us to be justified.)

What strikes me in the United States--which currently dominates scientific research in biotechnology and its industrial applications--is the intensity of the relationship between university researchers and industry, i.e., the larger companies as well as the small venture capital companies set up, with the support of finance companies, by university researchers to exploit a patent or an idea. There is a veritable proliferation of initiatives. There are thousands of contracts between large firms and university researchers, and there are 250 venturescapital companies which expand, or disappear, or are absorbed by large corporations.

Japan was traditionally very advanced in industrial microbiology applied to the agro-food sector. But it missed the start of the revolution in genetic engineering. It is currently making up the lost ground very rapidly: MITI (Ministry for International Trade and Industry] is helping, but it is mainly the larger firms which have taken the initiative and, contrary to the United States, venture capital companies pay little or no role.

The level of basic research in France seems to me to be of high quality, as is shown by the international renown enjoyed by a large number of our researchers.

However, in France we have not seen the rapid and varied research-industry relationships observed in the United States. There are relatively few venture capital firms, despite some striking efforts such as Transgene,

Biosys, Immunotech, etc. The large industrial corporations like Rhone-Poulenc, Sanofi, Roussel Uclaf, Lafarge-Coppee, Moet, and BSN have become aware of the stakes. Several years ago the government initiated a project to stimulate progress in this area with the Mobilization Program. Today, I think the top priority is to increase cooperation between the scientific community and industry through contracts and staff exchanges.

BIO: Are there plans for joint measures by the Ministry of Industry and the Ministry of Research in the field of biotechnology?

AM: Biotechnology is the ideal area for cooperation between quite dissimilar partners. This is true for firms and laboratories; it is also true for the ministries involved.

Coordination between the services of the Ministry of Industry and the Ministry of Research--which have often been unified in the recent past--has never stopped.

My idea of innovation is that science and industry, although governed by different rules and value systems, must cooperate closely without, however, either dominating the other.

Today, industrial competitiveness is synonymous with scientific innovation and research. Conversely, research cut off from industry runs a high risk of never producing concrete results. The two ministries thus cooperate on all major programs: A representative of my ministry serves, for example, on the Direction Committee of the biotechnology Mobilization Program and on the various industrial steering groups.

Several months ago, to strengthen interministerial coordination in the security area, the prime minister asked Pierre Creyssel, chairman of the Interministerial Group on Chemical Products, to expand the group's mandate to biotechnology.

In fact, coordination is not limited to the Ministries of Research and of Industry: The extremely diversified field of biotechnology requires that it spread its interministerial mantle much more broadly.

There is almost constant coordination between three ministries: Research, Industry, and Agriculture. There is also participation--depending opon the subject--by other very interested ministries: Health, Environmental Affairs, Consumer Affairs, etc.

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CSO: 3698/A190

BIOSENSOR RESEARCH IN FRG DESCRIBED

Paris CPE BULLETIN in French Dec 86 pp 69-72

[Excerpts] The study of biosensors is related to bioelectronics, a recent science at the junction of microelectronics and biochemistry. More specifically, the generic term biosensors encompasses sensors which detect biological or biochemical substances through active components of a biochemical or biological nature which produce physical effects or cause the appearance of substances which may be quantified. The sensors may be grouped into three major categories: enzyme sensors, microbial sensors, antigen-antibody sensors.

Status of Research in the FRG

Research on biosensors in the FRG began roughly 15 years ago. With rare exceptions, it has not until now produced operational analysis systems. The current state of research indicates the imminent entry of such systems on the technology market.

The list below identifies the major research groups and their primary research topics.

Universities:

Technical University of Munich:

1. determination of the kinetic effect of isotopes in reactions catalyzed by enzymes, in view of studying the variation of natural frequencies of isotopes in bioelements;

2. spectrometric analysis of titration systems;

3. production of amino acids by organic-chemical and biochemical reactions;

4. application of "marked bonds" to clinical diagnostic tests for tracking metabolic disorders;

5. development of enzymatic electrodes and fluid injection systems for clinical-chemical analysis and process control;

6. kinetic analysis of photoreactions and reactions in darkness; and

7. development of electrodes for the reduction and electrocatalytic oxidation of coenzymes.

University of Ulm:

1. analysis of halogenated organic compounds: trace determination processes;

2. biotic and abiotic deterioration;

3. trace analysis on polycyclic aromatic compounds;

4. electrochemical chromatographic detection;

5. specific emission of plasma during microwave excitation;

6. development of ion-selective electrodes;

7. construction of miniaturized glucosensors with pH sensitive field effect transistors; and

8. development of immunized electrodes (antigen-antibody reaction).

Aix-la-Chapelle Technische Hochschule

1. metal/semiconductor contact;

2. gas adsorption at semiconductor surface;

3. organic-inorganic semiconductors; and

4. gas sensors (particularly ethanol and acetic acid).

Technical University of Brunswick:

1. catalyst with polymer sulfonic acids and Lewis acids;

2. heterogenous biocatalysis: fixation of enzymes and cells on biological and synthetic polymers;

3. heterogenous catalysis: macrokinetic, including the kinetics of deactivation and of complex reactions;

4. theory and modeling of catalytic reactors; and

5. experimentation with semiconductor gas sensors for measuring ethanol, H_2, CH_4 and NH_3.

University of Giessen:

1. kinetics of structured systems;

2. control of the metabolism of carbohydrates and purines by regulating the activity of "pyruvate-kinase";

3. development of a quantitative and qualitative test for "pyruvate-kinase" isoenzymes in tissues and blood, for early tracking of carcinogenic substances;

4. development of analytic reactors with immobilized enzymes (i.e. measurement of the number of fluorogenic substrates);

5. fluorometric analysis of the transformation of carrier matrices;

6. development of dispersive measurement processes and the corresponding measurement probes; and

7. perfection of an impulse fluorometric probe for continuous measurement of particulate dispersion in a bioreactor. This probe is also used for characterization of the properties of the carrier matrices (gel, membrane).

University of Munster:

1. multiple bond reactions with immobilized microorganisms; and

2. perfection of immobilized microorganisms for breaking down undesirable substances (i.e. phenol, aromatic substances, alcane).

University of Marburg:

1. electrophysiology of the skin;

2. development of ion-selective electrodes for measuring Na+, K+ and Ca++; and

3. development of sensors of various physical-chemical parameters.

University of Hanover: biotechnology research, particularly on high temperature reactions.

University of Erlangen-Nuremberg:

1. administration of insulin in diabetics using blood biosensors (a license for this process was recently sold in the United States, in June 1986);

2. quantitative photometry of cell tissues; and

3. development of H_2, O_2, CO_2, H_2O_2 electrodes.

Institutes of the Max-Planck Institute:

The departments of the Max Planck Institute are devoted to basic research. Although the research themes rarely relate specifically to biosensors, it is nonetheless appropriate to mention the work of certain institutes which contribute to the development of knowledge in this field.

Association for Large-Scale Research:

The Association for Large-Scale Research--AGF--comprises 13 public institutes assigned to conduct research in fields requiring interdisciplinary cooperation and a concentration of substantial equipment and human resources (90 percent of their funding is provided by the federal government, the remaining 10 percent is provided by the Lander in which they are established). Two AGF members are involved in the study of biosensors.

Biotechnology Research Company (GBF):

1. process development (i.e. continuous fermentation of acetone and butanol);

2. development of on-line methods of analysis and process regulation. In particular, perfection of: a mass spectrometer for measuring ethanol concentration and a system for automatic analysis of glucose, NH_4 and phosphate concentration.

Juelich Nuclear Research Center (KFA):

1. breakdown of cellulose and hemicellulose;

2. biotechnological manufacture of "L" amino acids from synthetic amino acids;

3. fermentation of ethanol through the action of bacteria;

4. water treatment by anaerobic microbes;

5. membrane reactor for enzymes;

6. enzymatic catalysis;

7. intervention of microorganisms and enzymes isolated as biocatalysts;

8. biological elimination of nitrates; and

9. biochemical process technology.

Institutes of the Fraunhofer Association

The Fraunhofer Association is the largest institution for FRG contract research and receives 25 percent of its funding from the public treasury. Among its 38 institutes, only one is devoted to biotechnological processes, the Fraunhofer Institute for Interfaces and Biological Processes (IGB):

1. interface phenomena: impregnation, capillarity, surface modification;

2. development of processes for detoxification of blood, diagnosis of and therapy for cardiovascular disease;

3. development of membranes for separation operations such as gas separation, pervaporation, electrodialysis; and

4. application of enzyme technologies to the fields of medicine and agriculture-nutrition.

FOOTNOTES

1. Roger Bluzat, based on a memorandum from: Mr. Bavarez, CST 941, scientific office of the French Embassy in Bonn, entitled "Biosensors in the FRG"; the memorandum lists the names and addresses of the individuals in charge of the various programs mentioned above.

12798
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BRIEFS

FRG BIOTECH EXPERIMENTS IN MICROGRAVITY--Bremen, 22 May (VDI-N)--Many people will be able in the future to avoid the long road into outer space in order to conduct experiments under microgravity. The first gravity tower in the FRG, which is currently under construction in Bremen, will permit experiments in microgravity, at least for short periods of time. The giant tower, 138 meters high with a total diameter of 8.5 meters, is being built on the grounds of the university, and is part of the "Center for Applied Space Technology and Microgravity Research" of the University of Bremen. During a falling time of 4.5 to 9.5 seconds, microgravity experiments can be carried out in the areas of combustion technology, materials research or biotechnology, for example. [Text] [Duesseldorf VDI NACHRICHTEN in German 22 May 87 p 26] 12271

CSO: 3698/517

DUTCH UNIVERSITY GETS EUROPEAN, GLOBAL COMPUTER LINK

Rijswijk PT/AKTUEEL in Dutch 15 Apr 87 p 3

[Text] The first phase of "Dunet" (Delft University's Network) will be inaugurated by the end of April. At that time a number of the faculties at the Delft Technical University will be able to exchange scientific data by computer irrespective of what make the computer is. The users of this system will also have access to data networks of almost all universities throughout the world.

The installation of a network at Delft University is one of the main objectives of the data processing promotional project, which the Technical University has planned for its own use. Other objectives are the promotion of CAD/CAM, computer-aided engineering. The use of PC's in education, computer-modelling and simulation techniques.

The DU network was created at the request of a number of departments that use computers a lot. Thus it is intended primarily for technical and scientific computations. This network makes it possible to transmit, within a short period of time, large quantities of data to the computation center where additional processing takes place. If this information had to be transmitted through regular telephone wires it would take at least several hours or sometimes even a coupld of days.

Besides the computation work, the network also offers the possibility of communicating with other networks within the Netherlands as well as throughout Europe. Besides linking with the National Telephone System through a PSTN-Gateway, a link with Datanet 1 and SURF-Net. Communication may be accomplished using the European Academic Research Network [EARN]. Further comparable networks in the United States (BITNET) as well as in Canada (NETNORTH) can be accessed through EARN. In this way an exchange of scientific data is possible between almost all major universities abroad. In this day and age this is the first requirement for a technical university to maintain its leading position.

Broadband/Basis-Band

The Du-Net is a so-called broadband/basis-band network. The broadband network connects all buildings of the Technical University while the basis-network connects all computers within the buildings. The broadband network is installed in the ducts of the central heating system of the TU-quarters. Some

of the decentrally located buildings, that are not connected with the central heating system, are therefore not yet connected with the DU-net.

During the first phase, now being completed, basis-band networks are installed in the university's computation center, and also in the buildings of the departments of mathematics, computer sciences, electrical engineering and physics. These networks hold approximately 600 DU-net terminals providing access to 60 computer systems. This first phase of the network costs 3.2 million guilders. The departments have contributed about 0.5 million guilders.

During the second phase the first step will be to expand the network to the remaining departments of the university. Then there will also be an expansion whereby new services will be linked to the network. And ultimately there will be in Delft, a network with 2,000 terminals costing 10 million guilders. The total project is due to be completed around 1990.

Conservative

While planning for this network, the TU has taken a somewhat conservative attitude by merely applying proven technologies. Speaking in a technical sense, the network cannot be qualified as an original idea. However, for the users of this system it offers a large number of services and communication possibilities.

From among the eight contractors bidding on the first phase of the project only two met TU's most important requirement: The project as a whole had to be a turn-key operation. The contract was finally awarded to and carried out by ESD Electronics B.V. This company not only made sure that the TU will be kept abreast of any advances in computer technology but at the same time the city of Delft gained an infrastructure which might help the city become more attractive as a location for high-tech industries.

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AI DEVELOPMENTS IN FRANCE'S EDF

Paris CPE BULLETIN in French Feb-Mar 87 pp 51-53

[Article by Guy Benchimol, based on a 12 Feb 87 press conference by STERIA: "Artificial Intelligence at EDF"]

[Text] Consistent with their respective artificial intelligence strategies EDF [Electricity of France] and STERIA [R&D Company for Data Processing and Automation] have just concluded an important agreement. The agreement focuses on the "LEC" and "BOOJUM" expert system generators (ESG), which were developed by EDF's Design and Research Directorate and which stem from a series of projects by the team of Michel Gondran. (Footnote) (Who also serves as a senior lecturer in AI and Expert Systems at the Ecole Polytechnique)

The ESG's were designed to meet real needs and thus they have essential features, including the following highlights:

- In predicate logic (BOOJUM) high-level performance has been obtained using very fast unification algorithms which are duly correlated with advanced knowledge organization and optimized use.

- In proposition logic (LRC) there is a set of tools allowing systematic testing of the coherence of rule bases of (convergence, commutativity, consistency) and this is done independently of any inference strategy.

- The ability to generate production rules of level 0 automatically, starting from written conceptual knowledge in predicate logic: This link between products of level 1 and level 0 allows considerable productivity gains in creating, editing, and using knowledge bases. That possibility goes along with methodologies for the analysis and structuring of knowledge, which sharply reduces the time required to design and validate the systems.

Short Description of the Two ESG's Covered by the EDF-STERIA Agreement

Level 0 ESG + LRC

- This is a modular, user-friendly package (multiwindowing, dictionary, etc.) that enables the user to develop his own operational expert system very quickly and reliably.

- Based on proposition logic, it is constructed around an inference engine working in forward and backward chaining.
- It includes a module that checks the integrity of the knowledge base. The resulting final base is independent of the order in which the rules are enacted (commutativity).
- It can be connected to a relational DBMS.
- It is written in Pascal.

Level 1 ESG + BOOJUM

- It is a modular user-friendly package with a fast operation (the inference engine contains a particularly efficient pattern-matching algorithm).
- It supports all usual modes of knowledge representation: semantic networks, frames, objects.
- Based on extended level 1 logic (variables and variable relations), it is built around an inference engine working mainly in forward chaining.
- It permits the loading of any external program (procedural attachment).
- It can be connected to a relational DBMS.
- It is written in Pascal.

Expert Systems Developed by EDF

The following classification of the main expert systems developed by the EDF is somewhat arbitrary:
- administrative data processing,
- signal interpretation,
- process diagnosis and control,
- computer aided reliability,
- software engineering.

The table below indicates, for example, some systems using ESG, LRC, and BOOJUM. Their classification follows the categories mentioned above.

The EXTRA expert system provides alarm processing for a pressurized water reactor (PWR) and incorporates some noteworthy characteristics:
- It uses an expert system based on level 1 logic (BOOJUM) to interpret a topology and to generate an expert system based on proposition logic (LRV);
- It is a reliable system with quick design speed: 95 percent of its 5,000 rules are generated automatically through topology interpretation;
- It can function in real time;
- It is based on an approach (knowledge modeling and structuring) which can be extended to all the problems of controlling, monitoring, and maintaining industrial processes.

Perspectives

Today in the United States and Japan demand seems to be heading toward turnkey expert systems which are built around a reusable "shell" and are easy to use (not requiring a knowledge engineer).

Considering the variety of its data processing equipment and applications, EDF has already chosen this approach, even if some of the 50 expert systems developed thus far are using LIDP, PROLOG, or KOOL languages.

Table. Some Examples of Expert Systems Araanged by Application Area

Administrative data processing	:	MIRIAM: design and application of forecasting personnel management.
Signal interpretation (nondestructive testing)	:	sound interpretation for diagnosos of misplaced structures.
	:	interpretation of Foucault currents for quality control of steam generator pipes.
	:	monitoring of turboalternator sets.
Process control and diagnosis	:	Operating aid in normal or emergency situations for a PWR.
	:	EXACT: aid for loading nuclear material.
	:	diagnosis of the chemical condition of the secondary circuit of PWR material.
	:	EXTRA: alarm processing system for a PWR.
	:	alarm processing system for a Regional Electrical Network Operating Center.
Computer aided reliability	:	EXPRESS: supports reliability studies for industrial systems by automating part of the study.
Software engineering	:	Generator of a program to analyze response data by straightforward capture of the questionnaire.
	:	solving many problems involving combinations after a simple definition of the problems.

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HACKERS ACCESS BERLIN, HANOVER SUPERCOMPUTERS

Hamburg DER SPIEGEL in German 18 May 87 pp 244, 247, 250

[Text] Trouble at scientific computer centers: hackers have succeeded in breaking into the electronic heart of the machines, using the worldwide computer network free of charge and uncovering data protection gaps.

The message on the screen did not augur well. "For justifiable reasons," the management of the West Berlin computer center "Zedat" announced to its more than 1,100 student and scientist customers, "we must distribute a new log-in password. Please telephone the user administrative office personally." This was a rather cautious way of putting it.

Because behind this statement, which had been flickering across the screens of all the users of the computer at the Free University [FU] since the end of February, was an event that had only happened once in Berlin: "Zedat" (Central Institute for Data Processing) endured a hacker emergency for an entire week.

Students and scientists were surprised to suddenly learn that their old identification codes had become worthless. Passwords and "user IDs," the strictly guarded personal keys for computer use, had all fallen into outside hands, without exception. Around one dozen programmers worked feverishly through the night and over two weekends to bulkhead the system against unauthorized access through new security hurdles.

It was first two hackers--hobbyists in the data protection field and specialists in the art of travelling free of charge through the transmission system of large computer centers--who succeeded in breaking into the core of the FU computer.

On winding paths through several hundred of the many thousands of files, the two hackers moved step by step through the computer of the West Berlin university, finally reaching the access code of the programmer who can do whatever he wants with the super computer: the maintenance engineer of the computer's producer, Control Data.

A similar misfortune befell the operators of the same model of large-scale computer (the "Cyber" model) at the beginning of this year at the Hanover

Regional Computer Center and at the Bavarian Academy of Sciences. This happens much more frequently than is generally known--the system managers in question are fearful for their reputations if the break-ins were to be made public. It is, according to the computer chief in Munich, "not exactly a moment of glory when something like that happens."

Nevertheless, he succeeded in catching the guilty party in the act before he was able to reveal bigger secrets. Through a "stupid coincidence," he had come across one of the important codes, because a program print-out had inadvertently been dumped out to the wrong printer. However, since he then "put in only nonsense," he was immediately detected.

The situation was quite different in Hanover, where the system operators, as their leader Herrmann Luttermann reluctantly acknowledged, "have no idea what actually happened." Computer operations had to be shut down for one week after a presumed hacker break-in because, according to Luttermann, "all possibilities must be considered." "In computer centers such as these," a Berlin industry expert and data protection specialist commented, "there is clearly a lack of perspective." This type of electronic break-in is a sign of "outrageous security defects" in the operating system.

Zedat head Alexander Giedke in Berlin would rather look at the situation differently. He asserted that his antagonists are "obviously intimately familiar with the system." These were, he contended, "professional hackers."

However, the data burglars say that they cannot really be called professionals. After all, they say, they are high school students under the age of 20. Nevertheless, they have by their own admission "really immersed themselves in the system over the years." The two hackers (with the pseudonyms "Josef" and "Impudent") found dozens of ways in which to find out the passwords of legal computer users.

There are printers on which the full code is printed out, or one simply looks over someone's shoulder in the public terminal area; in this way, it is possible to use the university's large-scale computer any time of day or night.

However, the two computer virtuosos were not satisfied with simply stealing a little computer time, a very common practice at nearly all scientific computer centers. Josef: "Eventually you learn all the weak spots, and then you can start to collect accounts (access codes)." Prior to the big coup, he allegedly had about 150 of these codes. The rest then came about "like a puzzle." With a great deal of effort and a little luck, the Zedat hackers sounded out the files of various users over the course of several months, in search of more useful information, from which they inferred other access alternatives.

"The breakthrough," Impudent confesses, "was really a little accidental." Still, he did know immediately that "FU 531 AAA" was one of the most privileged access codes. Shortly thereafter, the actual holder of that code left behind some information in an unerased operating text through which the inner sanctum of the gigantic computer (memory capacity: eight gigabytes)

could be located: the memory location for all 1,109 users, their identification numbers and their passwords. Josef: "That was an overpowering experience."

For a good 2 weeks, the electronic data thieves were able to feel like the secret masters of the Berlin computer world, since they had access not only to all the files and programs of the FU computer, but also to the entire West Berlin computer network, including the "Cray-1" supercomputer. But in particular the intruders had what is often considered the most popular thing in the hacker subculture: dozens of opportunities to use the post office's data remote transmission network (Datex-P) at the expense of the university.

This privilege is generally granted by the scientific research centers only to those researchers who are dependent on free access to international data bases or direct exchange with foreign colleagues.

Many hackers can only afford their hobby of data travelling if they get access to the free Datex-P circuit. Whether he is going to the nearest "scene mailbox" around the corner, to the Pentagon's public data bases or to hacker friends in Tokyo, the well-informed hacker needs only a home computer, a telephone and a modem (which transmits the computer signals into the telephone and vice versa) once he has cracked the code of the involuntary sponsor.

But it was in fact the brazenness of their activities with the hot goods that brought the high flying of the Zedat hackers to a premature end. Because they gave in to pressure from hacker friends and passed along some of the privileged computer access codes, electronic visits to the Zedat system at night became far too numerous. In the end, Josef laments, there were around 40 computer freaks "romping around in there."

However, not even the accumulated misuse was noticed at first, as Zedat chief Giedke admits. Only when the secret computer tourists went in using the code of a programmer who was at that time on vacation did "a light go on" in the heads of the system managers. Then, of course there was an "immediate reaction": the legitimate computer customers were immediately issued two new passwords, one for direct "dialogue" with the computer and one for sending so-called batch jobs, complete computer programs.

Furthermore, Giedke said, the hacker break-in was "clearly criminal," and charges were brought by the legal department. However, that threat had little effect on the perpetrators. Ultimately, they had acted as honorable hackers, and in keeping with the morals of the subculture had not erased anything or disturbed any programs. Others could have done millions of marks worth of damage.

In addition, the hackers said, the Hacker Paragraph, 202a of the Criminal Code (maximum sentence of 3 years imprisonment), which was introduced only last year, applies only to data that are "specially protected." This is clearly not the case at many scientific research centers, they contended, because "if so we would never get in there."

Although that position is scarcely legally feasible--every password is itself a safeguard--it does touch on the central element of the problem: Because the large-scale computers that are used for education and research must be readily available to students and scientists, security efforts are by necessity limited. With sometimes up to 30 accesses that can be dialed in via telephone or Datex-P, monitoring becomes difficult. Users are also in many cases far too lax with their passwords, or they make them so easy that they are simple to guess. There is in fact a "hit parade" of the most popular passwords, as hackers know. Or researchers often derive their key word from their own personal circumstances: "Your girlfriend's name is a bull's eye possibility."

Warnings against this practice are included in all operating instructions, "but it can't be avoided," Giedke believes. Complex alphanumeric combinations must in turn be written down since they cannot be memorized--and these pieces of paper are also dangerous. A "truly airtight" university computer system is not practical, because "then we could seal off academic life."

Nevertheless, it is clear that access must be made more difficult. The Berlin hacker contest not only shed light on the permeability of the operating system of the Control Data machine; it also revealed considerable data protection gaps in the apparently purely academic operation of the computer. In their raid through the files, the hackers came across:

--extensive address registers in which current changes in address were also noted,

--personal data on children and young people, including the name of the parents or guardian and the health insurance billing number,

--registers of university employees, with gross salary and current state of health.

Hanns-Wilhelm Heibey, the leader of the technology division of the Berlin Data Protection Representatives, claims that such data "have no business on this computer." However, he says that he was not surprised by what the hackers found. There was already one case in which highly sensitive patient data from the university clinic found its way into circulation in this way. For this reason, the entire Berlin research network is going to be examined this fall. Wherever hackers were able to march through a computer, all the way to "where the keys are hung," it is necessary that "all personal data be thrown out."

The processing of these data in state institutions is at any rate only allowed on computers that are closed off to the outside. "However," the FU data chief says as justification, "we cannot always check on what the institutes are doing with the computer."

Nevertheless, the security barriers could be increased, according to data protection expert Heibey. The trying out of passwords could be prevented if, for example, three failed attempts were to automatically block access. Through an automatic recall device, "telephone attacks" would become more risky for electronic intruders. An even simpler solution is that of the head of the Hamburg research center, Hans-Joachim Mueck: He reduced the number of

those who can "log in" by telephone to 20, there are only seven privileged Datex-P users, and the central file containing the user codes is "so encoded that even we can't get in there." A change in passwords is possible only by way of a single access.

Mueck's colleague Giedke, however, believes that all of that is of no use in the old operating system still used in the Control Data facility. "If we do that, then the computer will be too slow." Until a new system is introduced (additional annual lease: DM 325,000), he thus has no desire to accept the bet offered by his young antagonists.

The hackers have promised to give him DM 500 if they are unable to reconquer the heart of the large-scale computer in the coming 3 months.

For the time being, Giedke cannot "rule that out in principle." Because of the approaching vacation period, his staff will be too sparse. The hackers' bet, Giedke says, is thus for the time being "unfair."

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BRIEFS

FRG: 250 DATABASES--Cologne (DPA)--The FRG currently has more than 250 electronic databases. There is particularly strong demand for information in the area of economics. According to a report by the Institute of German Economics (IW) the number of economic databases rose from 18 in 1984 to 74 in 1986, while the increase in the scientific and technical field was from 64 to 86. There are around 3,400 databases throughout the world. [Text] [Duesseldorf HANDELSBLATT in German 11 Jun 87 p 13] 12271

USSR-FINLAND DATA BANK--Kotkan Tietotekniikkakeskus Oy [Kotka Data Processing Center Co] has signed together with a Soviet foreign trade association two agreements concerning the establishment of data banks in connection with Finnish-Soviet bilateral trade. The parties to the agreement will establish in Finland a data bank which will contain information on Soviet export products and foreign trade organization. Information on Finnish firms willing to export and on their products will be collected in a corresponding manner to the data bank which will be operated in the Soviet Union. Technical solutions to both data banks are achieved by the use of Soviet hardware and Finnish software. The data banks will start serving their customers during this summer. The systems are intended to be fully operational by the end of the year. [Text] [Helsinki HELSINGIN SANOMAT in Finnish 16 Jun 87 p 28]

CSO: 3698/541

BRIEFS

FRENCH FIP PROJECT--FIP stands for Factory Instrumentation Protocol: It is the multiplex serial transmission system for data exchanges between sensors, actuators, and automata. The French FIP project was launched by the Exera user association, and studied by manufacturers (CGEE [General Electric Works Company], Alsthom, Telemecanique, and CSEE [Electric Works and Signals Company]) for development of the first FIP 001 component. FIP's functional aspect is currently being considered and it appears as a complement to the MAP protocol: It makes it possible to connect sensors and actuators to the systems themselves. The FIP network will be completely decentralized in a strategic spot along a monitoring and control process. The digital sensors will transmit their data via bus to programmable automata which in turn will send signals or measurement results to the system managing the process or, still locally, give instructions to a microprocessor-controlled variable speed drive which controls a continuous or reciprocating motor. A FIP club was created to promote (and also study) the French project. Its members are manufacturers (Telematique, CGEE Alsthom, Merlin-Gerin, Sereg), users (Exera, EDF [French Electricity Company], ELF [French Fuels and Lubricants], Peugeot SA), and research centers (ENSEM [National School for Advanced Electricity and Mechanics], INRIA [National Institute for Research on Data Processing and Automation]). In 1 year's time, the FIP concept will be integrated in French and possibly even foreign industrial products. [signed M.F.] [Excerpt] [Paris ZERO UN INFORMATIQUE in French 23 Feb 87 pp 34, 41] 25055/12859

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FRENCH GaAs, InGaAs ADVANCING INTO CIVILIAN MARKET

Paris L'USINE NOUVELLE (PRODUIRE Supplement) in French 19 Feb 87 pp 60-66

[Article by Alain Dieul: "GaAs: A Third Type of Chip"; first paragraph is L'USINE NOUVELLE introduction]

[Excerpts] Faster than silicon and more resistant to radiation, GaAs has already convinced the military. New manufacturing processes will reduce its cost and open up the civilian applications market.

One of the reasons that GaAs has not and will not soon replace silicon is that there is no immediate need to do so at the lower end of the product range. "Even if it is absolutely necessary to use GaAs in supercomputers and fiber optics, for pocket calculators and quartz watches silicon is not about to be superseded," says Jean-Pierre Noblanc, director of the Bagneux laboratory of CNET [National Center for Eelecommunications Studies]. GaAs is handicapped by its high production cost. A 2-inch GaAs wafer currently costs Fr 1,000 to produce, i.e., 10 times more than a silicon wafer of the same size! There are two reasons for this difference: First, GaAs is a most difficult material to manufacture and, second, unlike silicon, gallium is scarce and therefore expensive.

Pulling a GaAs ingot is not an easy task! The "pot" will contain arsenide and gallium, with the usual monocrystalline nucleus imprinting its characteristics on the bath. The presence of these two materials (whereas for silicon pulling there is only one) entails very delicate temperature gradient problems. The temperature must be absolutely even, which is often not the case, especially at the ingot's edge. Highly sophisticated methods such as those based on very strong rotating magnetic fields are needed for good quality.

New Markets in the Offing

The GaAs ingots are pulled according to the so-called vertical pulling "Czochralski liquid encapsulation technique." This causes for fewer dislocations (raptures in the symmetry of the wafer structure) than conventional horizontal methods. LEP [Research and Applied Physics Laboratory], belonging to the Philips group, is one of the most advanced laboratories in the world in the field of GaAs integrated circuit [IC]

research. To overcome dislocation problems, its researchers have developed a unique isolectronic doping technique using indium. Indium, which belongs to the same column as gallium, is electrically inactive and helps eliminate this inconvenience. "LEP produced its first 'zero dislocation' GaAs ingots 3 years ago. Today we can say that the 50 mm-diameter ingots produced in manufacturing conditions with our technique have all reached this high quality level," says Lazlo Hollan, assistant manager of LEP.

At Limeil-Brevannes, a number of LEP engineers are working on the integration of hyperfrequency circuits. Military applications had until recently dominated this field. However, other important markets are in sight much as the reception of television broadcasts from satellites at 12 GHz. "GaAs TV receiver head circuits are currently being manufactured in hybrid technology by RTC in Evreux. Depending on the demand, an IC version may also be developed," explains Jean de La Chapells, assistant manager at RTC-Compelec.

Microwave IC's should logically replace hybrid hyperfrequency circuits. An area in which LEP is a world leader. The current slack demand will assist its industrial implementation. However, especially for TV receiver heads, the potential market is very large. To have an IC in its catalog will then be of paramount importance.

For hyperfrequencies it was a problem of switching from a hybrid circuit to an IC. An intricate step for which research was more advanced than for digital GaAs circuits, where almost nothing was available. In this field the short-term LEP strategy is based on MOSFET technology which can be rapidly industrialized. Here the transistor can be built in two different ways. A current either flows between the source and drain electrodes, or it does not flow. The transistor's change in state through the gate control makes or breaks the current. The normally conducting transistor (referred to as normally ON) is easier to achieve but consumes more. "We are just about the only ones in the world to have normal OFF circuits that are far more interesting because they consume less. They allow us to adapt the GaAs circuits to large-scale integration technology (LSI and VLSI), whereas the normally ON transistors are restricted to medium integration because of their consumption," explains Jean de La Chapelle.

The OFF transistor is far more complicated to build. The gate must be cut. The doping of the channel requires a 0.1-micron thickness instead of 0.3. At LEP, 1-Kbit RAM memories have already been built. Access time for the circuit is approximately 3 ns whereas a similar silicon circuit requires tens of nanoseconds. Furthermore, to reduce the speed/consumption ratio, the memory uses two power supply voltages: 1.3 V for the memory array and 2.3 V for the operational amplifiers. Consumption amounts to 80 mW.

LEP is taking an active part in the GaAs initiative of the ESPRIT project. "We have an absolute need for these materials of the future. Without them Europe runs the danger of being completely crushed by the United States

and Japan. We are not behind in research, but that is not true for production, which in the United States, for example, is completely financed by the Department of Defense," declares Jean de La Chapelle.

The Difficult Union of Two Atoms

CNET's Bagneux laboratory suggested the concept of integrated microelectronics combining the electrical and optical functions in III-V Semiconductors, especially GaAs, in the early 1980's. It has already provided industrial products, e.g., the 1.3-micron laser of CIT-Alcatel. The first micro-optoelectronic monoliths to be built used only a small number of components. With the progress of technology and the circuit design, the emergence of optical signal processing circuits is already anticipated. These circuits will in turn give birth to optical computers at some point in the future. Meanwhile, CNET researchers are studying cold annealing technologies. Indeed, after having pulled the GaAs ingot, certain zones must be doped and the material must be heated for this purpose.

Here again the problems related to the two atoms composing GaAs arise. Arsenide is far more volatile than gallium and disappears from the mixture as soon as it is heated. The conventional diffusion of impurities in an oven has thus been replaced by ion implantation. However, because this destroys the crystalline structure of the GaAs, the wafer must be annealed. "At approximately 600 to 700 degrees C the support is already damaged, at 1,000 degrees C it is completely destroyed. Therefore, industrial technologies had to be developed for this operation," explains Jean-Pierre Noblanc. One method uses a laser which bombards the wafer with pulses that produce very little heat. Ultraviolet lamps are beginning to be used now. Another solution consists in depositing a silica dielectric that is impermeable to any diffusion of arsenide atoms. Ion implantation is a crystal growth method in the actual substrate which requires an extremely pure wafer compared to other methods in which the crystalline layer grows on the substrate. "The Czochralski method is the only way to abtain this quality," explains John Magarshack, manager of the GaAs IC activities at Thomson Semiconductors.

LCR (Central Research Laboratory) has been working on GaAs integrated circuits since 1975. Even though the components group started manufacturing IG's in 1980, it has continued intensive research activities on crystal growth. "We first efficiently monitored the growth quality in the vapor phases (VPE [vapor phase epitaxy]) but the uniformity was not perfect," explains John Magarshack. GaAs quality is measured by the mobility and density of the impurities. In VPE the slice is bathed in a gas that deposits atoms on the wafer, but because the operation is performed at 1,238 degrees C, others escape. To obtain perfect uniformity, the temperature must remain constant within a fraction of a degree over the entire slice.

At both LCR and CNET other implantation methods are being developed. One of them is molecular beam epitaxy (MBE), which consists in projecting

Ga and As atoms onto a substrate heated to approximately 700 degrees C. "Despite some excellent results, this technique still entails a number of problems. Under the electron microscope small lumps can be seen," says John Magarshack. At present metal-organic vapor deposition is frequently discussed. This method uses organic elements and allows the very slow growth of the layers as in MBE: The growth is even slower than that of a human hair. The problem is to find metal-organic bodies that decompose by releasing their metallic component.

This technology is nowhere near industrialization. The metal-organic components are highly poisonous as is the case for MBE, but, contrary to ion implantation, it takes a number of hours to make a layer grow. "If we can increase the speed, the advantage will be tremendous: The active part being above the substrate, the substrate could be of lower quality," confirms John Magarshack.

A further possibility provided by the metal-organic method is the deposit of GaAs on silicon. This is an ideal solution. "It would then be possible to use GaAs for just the optical parts and process the signal with silicon," explains Jean-Pierre Noblanc. In addition to the economic advantage, the silicon would serve as a solid support for the GaAs, which is a very fragile material. The problem remains very difficult to solve, because a crystalline layer must be grown on a support of a different nature. This is heteroepitaxy. At Bagneux, an exploratory study was launched 1 year ago. The difficulties are numerous: diffusion of silicon in the GaAs as soon as it is heated, different thermal dilation coefficients, etc.

At LCR in Corbeville, buffer layers of the GaAlAs type have been introduced in an attempt to solve the problem. At Texas Instruments a 1-K RAM memory has been built using the silicon growth method, but manufacturing still seems far away.

This year, however, with methods available at Corbeville, Thomson will market a mini-library of GaAs gate array circuits including circuits with 320 cells which can be rearranged into 1,000 gates dissipating 7 mW.

Submicron GaAs logic circuits could soon appear on the market. Strangely enough, they are easier to produce than silicon circuits. Indeed, there are fewer of the particularly delicate masking steps while manufacturing a chip (the alignment of the mask and circuit must be extremely accurate). Unlike silicon, GaAs is an insulating substrate that does not require an insulating makk. Whereas 22 masking steps are required for a submicron IC on a silicon substrate, only eight are needed on a GaAs substrate. These numbers represent the number of stages on a production line. "If you ignore the basic material, the already existing lines and the diameter of the slices, GaAs is cheaper than silicon," concludes Lazlo Hollan.

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FRG CHIPS, INNOVATIVE MICROELECTRONICS TRENDS THROUGH 2000

Duesseldorf VDI NACHRICHTEN in German 22 May 87 p 43

[Article by Regine Boensch: "Trends in Microelectronics Through the Year 2000--Chips Define the Structural Change--Weinerth: 'The Current Rate of Innovation Will Be Continued'"]

[Text] Duesseldorf, 22 May (VDI-N)--"Microelectronics and information technology will define the structural change in the economy through the end of 1990s," according to Dr Eng Hans Weinerth. In his reflections on trends in microelectronics, the manager of Philips GmbH foresees a rapid pace of innovation. For the FRG, with its lack of raw materials, it is an economic necessity to make headway in the international competition surrounding the "new technologies" and in the branches of industry associated with them.

According to Weinerth, the market for microelectronics is defined by two factors: actual equipment production and the share of microelectronic components in the systems and equipment. In the first area, the Philips manager and head of the technology division of VALVO anticipates through 1990 an average yearly growth in the FRG of eight percent. In this way, the annual production volume would rise from DM 58 billion in 1985 to DM 85 billion.

"In a worldwide comparison, this trend is above average," Weinerth says, and it can be largely attributed to the balanced structure of industrial customers for consumer, industrial and automobile electronics, as well as for data processing and telecommunications. With respect to components, he predicts that the increase in the volume of equipment will lead to a yearly growth rate for components of nine percent, whereby demand in the areas of automobile electronics and data processing will play a leading role.

"The biggest and most innovative medium for growth remains microelectronics." Its market share should double by 1990. And according to Weinerth, this will in turn be linked with significant consequences for the structural change in the economy.

Thus, microelectronics--as the key industry for information technology--is causing a shift towards the tertiary sector. Whereas in 1980 60 percent of all workers were employed in the infrastructure and service sector, this figure will have risen to 75 percent by the year 2000. At the same time,

Weinerth says, what is needed, in addition to "an expansion of application-oriented training for information technology in non-technology specialized areas, is an increase in graduates in engineering and the natural sciences." The change in needed qualifications can only be dealt with through linking education and in-house training, he said.

The manager of Philips GmbH and trustee of VDI believes in a "technology pile-up" at the colleges and research institutes that can be dismantled by a targeted exchange of information between colleges on the one hand and small and medium-sized businesses on the other hand. Up to now, the technology transfer of scientific findings has only been successful, he says, when industry possesses the potential for "translating" the findings into products through their own research and development.

"Structural change is not a task that will be completed tomorrow; it is a permanent challenge." In assessing the time frame in which microelectronics will remain a significant engine for structural change, Hans Weinerth considers technical development trends decisive.

Since Kilby and Noyce created the first integrated circuit with 10 components in 1960, progress in the area of production technology in particular has lead to tiny structures of 1 to 1.5 micrometers. Advances in lithography, process technology and doping technology have reduced lateral and vertical structures. Better use of surfaces and higher circuit speeds have been the result of this. Because the methods of process technology have become increasingly free of error, the chips have become increasingly inexpensive. Today, more than 150 separate steps must be mastered in the production of integrated circuits in order to satisfy demands for high complexity and speed as well as for low energy consumption.

Light optics is a lithographic tool for producing the smallest structures that can presently be placed on a silicon chip. "It is foreseeable that light optics will not significantly surpass the 0.5 micrometer limit of resolution because of physical reasons," Hans Weinerth says. "The most promising candidate for the next generation of lithography is thus the X-ray, especially the soft X-radiation that emerges as a waste product in particle accelerators in the form of synchroton radiation." The joint project of the German semiconductor producers with the Fraunhofergesellschaft has shown, he says, that smallest structures of 0.3 micrometers can be produced in this way. Weinerth sees similar development potential in etching technology, insulation and metallization. He is also counting on a decrease in flaw density.

What is generally of interest in characterizing generations of chips, and thus their complexity, is the dynamic memory potential of so-called DRAMs (dynamic random access memory). "A technology with micrometer structures permits today the production of DRAMs with one megabit of memory." According to Weinerth's remarks, submicron technology, which is to be made ready for production by Siemens and Philips in their mega project by 1989, will achieve a complexity of four megabits. In the second generation of this technology, he predicts for 1995 memory with a level of complexity corresponding to 64 megabits and logic chips for highly complex signal processing, such as language

identification in the acoustic range and pattern recognition in the optical range.

Millions of geometric details require parallel calculating in so-called vector computers. At the same time, Weinerth says, the number of application-specific logic systems that must be designed increases. Systems specialists and their know-how in handling CAD tools are increasingly in demand.

The expenditures for research, development and the production of chips associated with the rapid change in generations will strengthen selection among chip producers, Weinerth says. For the 1990s, he calls for a concentration of know-how coming from European firms and research institutes. In this sense, "final decisions on goals, organization and expenses within the framework of Eureka have not yet been made."

Weinerth is still uncertain whether the pace of innovation will enter into a saturation phase at the end of the 1990s. "New materials, such as gallium arsenide, that permit extremely high circuit speeds, first signs of optical, parallel information processing, bio-chips, about which there exist very unclear notions today, even within the scientific community--all of these things give one cause to think that the end of the innovation phase will come well after the turn of the century."

12271
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THOMSON SPECIAL COMPONENTS BRANCH ANNOUNCED

Paris L'USINE NOUVELLE in French 21 May 87 p 27

[Article by Claude Amalric: "Thomson Reestablishes Components Branch"]

[Text] The new unit, directed by Jacques Caumartin, will strengthen its positions. Particularly in the military field, despite an uncertain economic situation.

A Special Components Branch (BCS) was established on 29 April by Thomson-CSF to combine the departments and affiliates excluded from the Thomson-SGS agreement, which was limited to civilian semiconductors. Only affiliate LCC, devoted mainly to condensers, escaped the BCS: it remains attached to CSF without intermediary.

The new branch has 5,000 employees in military (60 percent) and professional activities totaling 2.7 billion francs. Jacques Caumartin, 48, named director of BCS, emphasized: "It is a concentration of unique capabilities for each of the complementary specialties that has top rank in Europe, and a world rank ranging from second to sixth." The major competitors (Hughes, Raytheon, GE, Plessey, AEG, and Siemens) are in fact only competitors on two or three out of the strategic components developed by the branch (progressive wave tubes, hybrid circuits, and CCD charge transfer circuits for infrared).

Yet, fortune is not assured. "If only the General Directorate for Armaments could pattern itself after the American Department of Defense, which finances its industry to the extent of 70 percent," dreams Jacques Caumartin, referring to resources provided by the state budgets (50 percent of the total, at best). Hence, the necessity to export, which is a priority objective.

In regard to exports, the boss of the Electronic Tubes Division (DTE), the big portion of BCS, is advancing on familiar territory. However, the 28 percent of sales that the DTE achieves in the United States has become a nightmare for measure of performance, causing a 3-percent drop in profitability of the division, which nevertheless stayed out of the red last year. "With 6 francs to the dollar, no Frenchman can earn money by exporting to the United States," in the view of Jacques Caumartin.

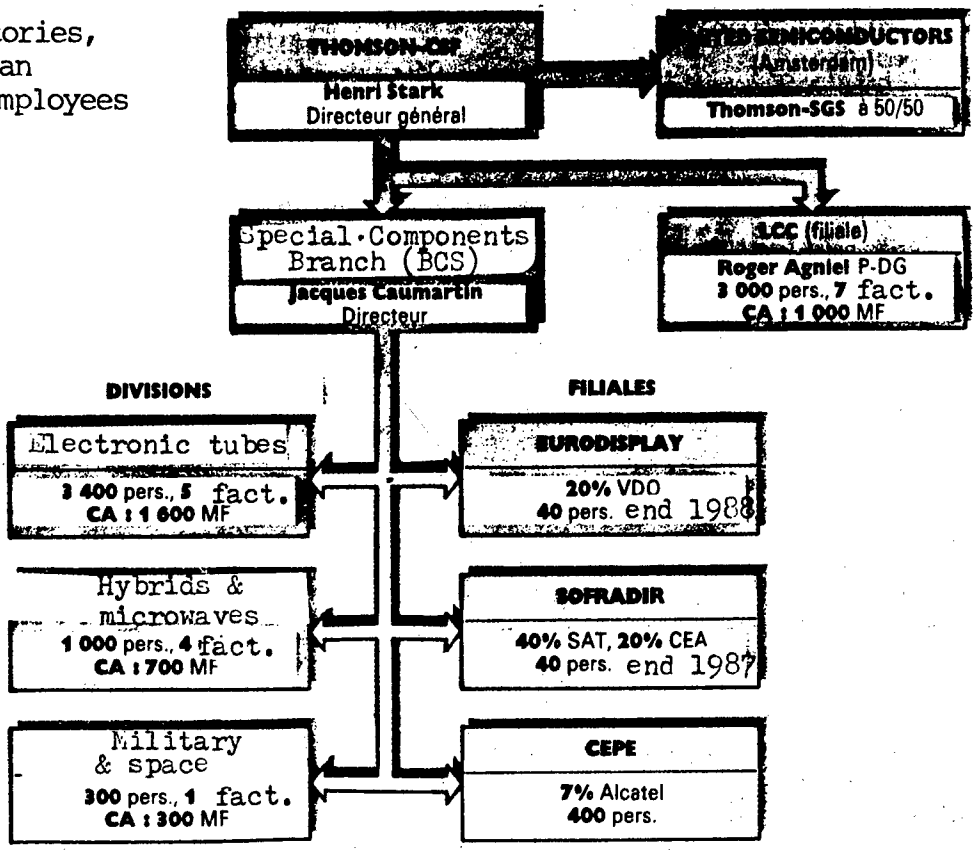
There is a risk concerning military orders especially for DMS, the specialized division (300 employees in Grenoble), and for DHM, the division devoted to

hybrid circuits. Despite the cautious proposals of their new branch director, it is hard to see how these divisions can balance their accounts for the current year, knowing the cost of their research.

Less affected because primarily civilian, the LCC affiliate should rightly achieve a balance this year, after a severe reorganization that closed three factories and established the Marly factory. In components, times are hard for everyone.

Concentration of Unique Capabilities

20 factories, more than 8,000 employees



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CSO: 3519/134

PHILIPS NIJMEGEN CHIP FACTORY CONSTRUCTION ON SCHEDULE

Rotterdam NRC HANDELSBLATT in Dutch 16 May 87 p 13

[Article: "Chip Factory Hermetically Closed"; first paragraph is introduction]

[Text] After today the production rooms at the Philips chip factory under construction at Nijmegen will be closed so that they can be kept dustfree. In the cleanest rooms of the chip factory at most one dust particle per 30 liters of air is permitted. In the near future, only personnel in special clothing is allowed in.

Today, Philips' finest, newest, and biggest chip factory at Nijmegen closes--indeed, closes hermetically. Europe's most modern chip factory, which is being built within the framework of the megaproject, which is being subsidized by 200 million guilders, has to be ready for production by the end of this year. That means, that after tomorrow not a single particle of dust larger than a half micron--1/2 of a millionth of a meter--is allowed to penetrate within. Therefore, the factory under construction is after today closed to everyone except a small team of qualified coworkers on the project.

Philips describes the effect of a dust particle upon the advanced chips that will be manufactured in the factory as being like "a bomb in the center of a large city." After today starts the process of making dustfree the production rooms where chips with submicron structures will soon be made. The megachip, the product which is ultimately the focus of the megaproject, will not be manufactured, though, in the new factory until the early 1990's. The submicron process will be applied first at Eindhoven, and "according to market demand" will be moved to Nijmegen, where it can be produced in large scale, according to Dr Th Holtwijk from Philips' component division.

On Schedule

According to Holtwijk, Philips is still on schedule in the 5-year megaproject, which he prefers to describe as "the goal of mastering the submicron technology." At the end of 1988 this miniaturization technology will at first be applied to the 256K memory chip, the generation preceding the megachip. The megachip, which has four times greater memory capacity, will indeed be then available in the concern, but only a couple of years later will it be taken into large scale production.

By the end of this year, the production of 1.5-micron chips will be started at Nijmegen. After that the process will be gradually perfected in order to master--through the 1.2-micron and 1-micron--the 0.7-micron level.

Philips has always defined the megaproject, which is carried out together with Siemens, as something that, above all, will have to become "a technological success." Yesterday, Holtwijk said also that he is convinced of the "commercial success" of the project. "And then I intend to make a profit," says Holtwijk.

Philips has never been strong in the area of memory chips, the sector where the megachip belongs, but it badly needs the technology for the further development of other chip categories. Now that the memory chips that are increasingly smaller are becoming a standard product and getting more and more "application specific," Philips appears to have reserved for itself an important market.

Last year, the chips division of Philips--for the first time since 1985--was profitable again, and had a turnover of more than $1 billion (about 2 billion guilders). On the global chip production list Philips moved from the ninth place to the seventh.

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ADMINISTRATIVE DECISIONS AFFECT FRANCE'S CNRS

Paris LE MONDE in French 15-16 Feb 87 p 8

[Text] On 13 February the Council of State made two decisions concerning the functioning of the National Center of Scientific Research (CNRS). In the first decision the Council of State canceled the elections which took place in March 1983 for the designation of members of the eight sections of the National Committee of Scientific Research.

In the second decision the Council of State canceled the decision by Alain Devaquet, minister delegate in charge of scientific research and higher education, which was made public by a communique dated 19 June 1986. This decision had suspended the work of sections of the Central Committee for Scientific Research, and particularly the work of committees presiding over competitive recruitment examinations and provided for the temporary recruitment of contract researchers for the CNRS.

In a decision dated on 12 May 1986 the Council of State had struck down Article 6 of the decree of 27 July 1982, determining the rules for elections to the National Committee of Scientific Research. At the time it considered that the rules set forth in this decree distorted the principle of elections.

Illegal Foundations

The first of the two decisions, which was made at the request of the Autonomous Trade Union of Teachers of Medicine, therefore only drew the logical consequences from the decision made on 12 May 1986. As the elections to the national committee were conducted on an illegal basis, they should be cancelled, if they were regularly contested.

The cancellation of the decision contained in the communique under which Minister Devaquet believed he was drawing the logical conclusions from the decision of 12 May 1986, was based on the view that he did not have the power to make it. In effect, considering in particular the principle of the autonomy of public services, the minister did not have the power to order organizations provided for by the statutes of the CNRS to cease functioning and to provide for the temporary recruitment of contractual personnel, disregarding the rules set down in the statutes.

Furthermore, the Council of State concluded that the measures adopted were not the necessary conclusions to be drawn from the order issued by the Council of State on 12 May.

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NETHERLANDS: DEKKER COMMISSION S&T POLICY PROPOSAL DEBATED

Rotterdam NRC HANDELSBLAD in Dutch 27 Apr 87 p 17

[Article by Eefke Smit and Paul Friese: "Dekker Commission: 'Decentralize' Technology Policy"]

[Text] Eindhoven, 27 Apr--The Dekker Commission, which was set up to provide the government with recommendations on technology policy by 1 May, did "not want to turn everything upside down."

Chairman Wisse Dekker, former president of Philips, immediately concedes in his initial comments that today's report, entitled "Exchange Between Know-How and the Market," is much less revolutionary than the report issued last month by the other Dekker Commission, advising the government on health care issues.

Subsequently, this report will probably receive less publicity, according to Dekker, although the "alert reader" should be able to understand here as well that it affects him personally. Dekker: "Without a sound technology policy, our industry cannot function properly, which is detrimental to prosperity and ultimately to every citizen."

According to the members of the commission, a broad vision of what the government can and cannot do and an assessment of current technology policy are clearly not lacking in the report, but they "can perhaps be found only implicitly in the report's recommendations." The fundamental philosophy--according to an explanatory note--was that the government can never centrally manage developments in the market sector. Dekker: "In our advisory report, we recommended the decentralization of as many government activities as possible; private industry must for the most part do this itself. You can remove barriers and provide incentives, but if a response does not then follow from the companies, then the existence of a Dekker Commission means nothing."

Commission member Dr H.H.F. Wijffels, chairman of the board of directors of Rabobank: "This basic assumption should not be underestimated; we spent quite a few meetings discussing it before we agreed on it."

Organizational

Although the commission also recommends "decentralization"--primarily through the establishment of regional technology centers--the concrete question of what activities and people at the ministry itself can be eliminated is not really addressed. Dekker reacts to this diplomatically: "You can scarcely expect a statement from us on that. That is a matter to be examined by the ministry itself." He is interrupted by fellow commission member Wijffels: "If you really want to know, it will affect around 80 people. We don't have anything to say about that ourselves, but we have in fact seen rather detailed plans about that."

The commission viewed the implementation of technology policy primarily as an organizational problem. Or, as commission member E. Wintzen, managing director of the BSO software firm, calls it: "The day when you could throw a bundle of money on the table and add a new department to a ministry is gone. Today it is a question of efficiently organizing what you already have." In this sense, something must be done with respect to three noted shortcomings: technological innovations are still inadequately exploited in medium-sized and small companies, training is insufficient and the government could operate more efficiently. Many of the training measures are being left up to labor and management, and the transfer of know-how to medium-sized and small industries is indeed being undertaken.

Lessons learned from experiences in Sweden and Baden-Wuerttemberg, among other places, resulted in the recommendation that 20 to 50 regional information centers be established for advising provincial small businesses on technological applications and for serving as intermediaries in making contacts with research institutes. Any existing activities in this realm, such as those of the National Industry Bureau, must be fit into the new centers.

Dekker: "Perhaps at first glance this seems to be nothing new, but it really is. If this succeeds organizationally, then we will have clearly achieved a breakthrough. Then there will be an infrastructure for know-how in which future technology policy will be formulated from the bottom up. The regional centers report to a central agency on the possibilities and needs of industry. This is taken into account in the formulation of national technology programs.

"A good structure is an excellent basis to which things concerning content can be added later. You must look at this as a dynamic plan."

The question of whether the Netherlands needs one technology institute to function as an umbrella organization over all other research institutes--one of the objectives of the coalition agreement--was given a "no" by the Dekker Commission. Dekker: "This type of institute, as mentioned in the coalition agreement, is not in keeping with our objective of decentralization. We reached an agreement on that point rather quickly."

There is, however, an agency that coordinates the activities of the regional information centers, awards subsidies, implements technology programs and passes judgement on the "missions" of the existing technology institutes.

Each technology institute receives a new mission in which "market-oriented" functioning--meaning a large number of orders for or in conjunction with industry--is much more important than it currently is. The "mission" evaluations are forwarded to the respective ministries, which themselves decide whether they will be guided by these evaluations.

"Our recommendation is much more a question of organization than one of money," Dekker explains again in conclusion. The goal is that industry, education and science in our society learn to speak the same language. The fact that this is difficult was immediately apparent to us on the commission, where representatives of industry, education and science were gathered around one table. It took us about 6 weeks before we really understood one another."

The Dekker Commission met for a total of approximately 100 hours in order to arrive at the present recommendations. Each of the members also served on subcommittees, and spent a similar amount of time on preparatory work. Dekker: "It was an infernal pile of work."

Members of the Commission

Prof Dr W. Dekker (chairman), former president of Philips; Mr A.A. Loudon, chairman of the board of directors of Akzo; Dr H.H.F. Wijffels, chairman of the board of directors of Rabobank; E. Wintzen, general managing director of BSO; Eng J.J. Kaptein, former chairman of the board of directors of Oce-Van der Grinten; Prof Eng W.C.L. Zegveld, director of policy studies at TNO [Dutch Central Organization for Applied Scientific Research]; Dr. M. Epema-Brugman, chairman of the General Energy Council; Prof Dr Eng H.H. van den Kroonenberg, vice chancellor of the University of Twente; Prof Dr Eng J.M.M. Ritzen, professor at Erasmus University; Dr J.K.M. Gevers, chairman of Council for Higher Vocational Training

De Korte Gets Gray-Toned Recommendations

Rotterdam, 27 Apr--"We need recommendations with some weight to them," Minister of Economic Affairs De Korte said 6 months ago when the Dekker Commission was being established, because "technology policy will be a decisive policy issue in the coming 5 to 10 years." The commission's duty was to give an evaluation of current technology policy, to provide recommendations on a new technology institute and to indicate a direction for new policy.

Now that the report is out, however, it is only barely possible to answer the question of whether De Korte's high expectations have been fulfilled. Even the commission refers to its report as "recommendations in carefully chosen gray tones."

Although Minister De Korte said at the ceremony at which the commission was established, "I have great expectations for the technology institute operating separate from the government," which was to be under his jurisdiction, this institute will not come into being. The existing technological institutes, such as TNO, the Energy Research Center Netherlands, the Hydraulics Laboratory, etc., which would have been under the jurisdiction of this institute, remain under the competency of the relevant ministries.

The commission thus confines itself to repeating the long-cherished desire that the large technological institutes function according to the TNO model, meaning a more market-oriented operation, for and in conjunction with industry. How exactly this is to be done is not addressed. The commission did not voice an opinion on the issue of whether fewer subsidies should be given if institutes fail to expand their contract research.

Network

An evaluation of the "mission" of the institutes, about which there is presently a great deal of uncertainty, is being left up to a new advisory board, which has yet to be set up. This board must present "weighty" recommendations, not to the minister primarily responsible for technology policy, but rather to the ministers whose ministries cover the subject matter in question. As long as the institutes continue to fall under various ministers, the hope for change appears to be small, despite the "far-reaching consequences" that the commission believes cannot be avoided. The commission apparently did not want to get tied up in the struggle for competency among the ministries.

One new proposal by the commission is the establishment of a regional network of information centers intended to provide for the transfer of know-how to medium-sized and small companies. Such a network already exists in Baden-Wuerttemberg, and it has yielded good results. The nice thing about this West German model is that this type of regional center is shut down and moved to another area if there is no interest in it. The commission does not propose this, but there is the possibility that more regional centers will be added in the long run, because of "dynamics."

The national technology programs recently launched by De Korte and presented as "interim policy"--programs that the commission was informed of only later--were given the OK to continue. The commission calls them a "good start," but without indicating why. In general, it does not present a well-reasoned evaluation of the current policy by the Ministry of Economic Affairs, even though that was its assignment. In this regard, it simply proposes that another 300 million guilders be appropriated for existing support measures by applying them more flexibly.

At a Distance

Although the commission is rather consistent is applying its "at-a-distance-from-the-government" philosophy, it strangely enough has nothing to say about the organizational consequences for the Ministry of Economic Affairs itself. One of the commission members let it slip that "they could lose 80 staff members," and even that "there are rather detailed plans about that," but the report itself is silent. The fact that people at the Ministry of Economic Affairs are happy with this report is in this regard quite telling.

Another salient element is that the commission is attaching so much weight to the establishment of a separate advisory board for technology policy, and that it does not recommend integration with the existing advisory board for science

policy (RAWB) in the short run. If the cabinet does decide to do so, the commission will welcome the move; for the time being, however, it is pleased to have two advisory boards covering what is in fact the same area, reporting to the same subcommittee of the Council of Ministers.

That will perhaps be offset if the government follows the recommendation of the commission that top-level research and top-level education at universities and technical institutes be combined into "centers of excellence," which should make themselves useful to industry. The initiative for this must go out from universities and institutes themselves, but it remains questionable whether the ministers in question will give "their" institutions the opportunity to do so. De Korte's political position within the cabinet appears to be too weak to withstand any objections from colleagues such as Deetman.

Summary of the Commission Report

Rotterdam, 27 Apr--A summary of the most important points from the recommendations by the Dekker Commission on technology policy:

Organization

--A seven-member, permanent advisory board, to be established, makes recommendations to the minister of economic affairs on:

  --the desirable "policy mix," e.g., the proportions of various types of subsidies;

  --the evaluation of policy;

  --the technology programs;

  --the role of the Netherlands in European activities;

  --the assimilation of signs concerning strong and weak sides of trade and industry as brought forward by the regional information centers.

--The question of whether this advisory board can be combined with the Advisory Board for Science Policy (RAWB) should be examined within 3 to 5 years.

--An agency, to be established, implements technology policy on behalf of the minister of economic affairs, such as:

  --the technology programs;

  --granting of technical development credits;

  --coordination of regional information centers;

  --handling European projects on a national level.

--The agency can also do work for other ministries.

Dissemination of Information

--The establishment of around 20 to 50 regional innovation information centers is intended to provide for a network of contacts for the transfer of knowledge.

--The innovation information centers will provide information, answer questions and act as intermediaries.

--The centers will have their own limited, subsidized budget that can be spent without too much red tape, for small projects and internships, for example.

--The activities of the centers must be a continuation of the significant endeavors that are already going on in the regions, such as the activities of the National Industry Bureau. An organizational consulting firm should study the question of whether and how the centers can be integrated into the regional branches of the National Industry Bureau.

--The government must provide the big companies with information on what small potential suppliers are located in their immediate vicinity.

Programs

--The current technology programs--initiated as interim policy--for microelectronics, biotechnology and new materials can be continued with greater "industry-oriented" allocations (70 million guilders).

Europe

--The EC technology programs should remain of adequate scope.

--Medium-sized and small companies should be assisted in participating in these programs.

Foreign Companies

--More foreign high tech companies should be attracted by the Netherlands.

Institutes

--The advisory board must in the short run submit significant recommendations to the pertinent cabinet minister concerning the "mission" of the institutes.

--Basic and targeted subsidies are converted into "mission subsidies." Part of the subsidy to TNO will have to go into research for small business. Unique research facilities demanding very high investments must be established on an international basis.

Centers of Excellence

--Top-level research and top-level education should be combined at centers of excellence. Trade and industry can be involved in these centers through direct participation, contract research or participation in a center program board. It is desirable that these centers combine strategic research and education. The initiative must come from universities and institutes themselves.

--The dual appointment of scientists to a university and to a center should be supported. Retraction of this dual titling should be considered when leading researchers leave.

Training

--The regular educational system must have the opportunity to join the market for continuing education. Continuing education itself must be paid from the wage gap and be organized more intensively, according to industrial branch, by labor and management.

--In its recommendations for the regular educational system, the commission agrees with all the policy proposals currently ready to go into effect: the regular educational system should strive for awards according to performance, additional income, the elimination of automatic periodic raises, performance evaluation for dismissals and layoffs instead of the last-hired-first-fired principle for teachers.

--The influx into technical education must be increased not by heavy, centralized instruments such as fixed numbers, but rather by targeted, independent information.

Commission Requests Another 550 Million Guilders

Rotterdam, 27 Apr--The Dekker Commission is requesting a total of 550 million guilders more for technology policy:

--The Ministry of Education and Science is allocated an extra 175 million for:

  --continuing education: 20 million a year

  --equipment for vocational education: 75 million a year for 5 years

  --equipment for scientific education: 60 million a year for 5 years

  --Technical Sciences Foundation: 20 million a year

--The Ministry of Economic Affairs is allocated an extra amount that comes to 375 million guilders a year for:

  --innovation stimulation program (Instir): 145 million

  --technical development credit: 40 million

--national technology programs: 70 million

--Eureka: 50 million

--transfer of know-how to medium-sized and small companies: 70 million.

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CSO: 3698/441

FRENCH FIRMS CONSIDERING JOINT VENTURES IN USSR

Paris L'USINE NOUVELLE in French 26 Feb 87 pp 68-69

[Article by Roselyne de Clapiers: "USSR: The Challenge of Joint Venture"; first paragraph is L'USINE NOUVELLE introduction]

[Text] Who will benefit from the USSR's opening up to foreign investment? Candidacies are lining up.

"Rhone-Poulenc is interested in the possibility of establishing joint ventures in the USSR." Maurice Mallet, responsible for CEMA affairs in the French chemical group confirms: "With an annual sales figure of Fr 1 billion in the USSR, industrial cooperation can be considered." This cooperation can take the shape of French-Soviet joint ventures in the USSR, among other things. However, "it will take time for this to take effect."

Philippe Pegorier, commercial attache at Lectra Systemes (machinery for the garment industry) who was contacted by Technoproimport last May, has made a joint venture proposal to the Soviets: "We have been in this market since 1985 and obtained several contracts there. Now we are making bids on the modernization of 26 garment plants. Investing there would be one way to remain in that market, which we will lose if we are not ahead of our competitors."

Gustave Grendin, general manager of Interagra, hopes to sign two joint venture contracts by the end of 1987 involving Jean-Baptiste Doumeng's company along with another French technology supplier. Interagra's role would be to buy the joint ventures' products. The two projects involve the production of modules for a feed mill and corn harvesting equipment. However, this technique of payment in kind cannot be applied to other investment types like the manufacture of powerful tractors, for which there is no real market in France. Yet, the USSR would like joint venture companies to balance their expenses abroad (supply of raw materials, salaries of expatriates, and dividends) with exports.

It is clear that joint ventures in the USSR still pose problems--even for the most optimistic companies. Hence, there is deliberate caution on the part of most French manufacturers. In fact, Soviet legislation on joint ventures is dated January 1987, but other laws, notably on fiscal aspects, are not yet ready.

Roger Sabourot, marketing manager of Vestra, recently in charge of renovating a garment plant in the USSR, explains his dilemma as follows: Producing high-quality menswear in the USSR presupposes the availability there of usable raw materials. Soviet production, however, does not meet the requirements, thus the raw materials would have to be imported from the West. This reduces the economic attractiveness of a joint venture that has to balance its foreign currency expenses with exports. As a matter of fact, the salary advantage of producing in the USSR does not suffice alone to make the products competitive for export.

The Soviets, however, are very eager. For them, the creation of joint ventures serves several goals: to import advanced technology to develop the industrial infrastructure in such sectors as light industry, the chemical, petrochemical, and steel industries, and engineering, in conjunction with small- and medium-sized companies; to benefit from the sales networks of Western companies to diversify Soviet exports, which depend too heavily on raw materials; and finally, to help balance foreign trade. Since March 1986 some 40 French companies that have regular business contacts with the USSR have been invited to submit bids. Some 20 companies are closely studying this invitation (see box 2). This opening up is a real breakthrough in Soviet economic doctrines and is likely to spread to other CEMA member states, with the exception of the GDR.

Western manufacturers are closely watching the decentralization process in the USSR as it would permit dozens of organizations to trade abroad without having to go through the Ministry of Foreign Trade. This will also apply to joint ventures.

Yet, many think it is unrealistic to encourage companies that do not know the USSR well to embark upon this new type of cooperation. Why? Because a great many questions vital for economic survival remain unanswered.

--On the legal level, certain questions concerning patent rights remain open.

--As far as corporate operations are concerned, the texts are deliberately silent. When asked about this, Konstantin Baktov, Soviet trade attache representative in France, underlines the importance of negotiating and stipulating all details on the future company's activities in the articles of incorporation. Since the USSR does not want to reserve special zones for joint venture companies "so that they can be close to their suppliers," there remains room for pragmatic discussion. The result is that the best negotiators will have the best contracts.

However, there is one question that worries observers: the constant reference that is made in the law to "the price on the world market." What does this mean, given the fact that the ruble is not transferable? Thus, the foreign partner will also have to reach preliminary agreement with his Soviet suppliers or the ministries involved on price guarantees for raw materials needed as well as on overhead (rent, water, electricity, etc.). In a word, it will take much time, patience, and creativity to find solutions that will ensure long-term profitability of the projects.

[Box 1, p 68]

A totally New Legal Structure

Daniel Guyot, lawyer and legal contact in Paris for the Soviet offices of Iniurcollguia, has the following comments on the joint venture legislation.

Some essential clauses include:

--Guarantees for the Soviets: at least a 50-percent share in the capital and the right to appoint the CEO and the general manager;

--Guarantees for the foreign partners: no confiscation of goods or administrative takeover and indemnification in case of nationalization.

Much room is left for negotiating on important issues such as decisionmaking processes, the respective shareholdings, the company's life span, guarantees on liquidation procedures, initial capital input, the joint venture's domestic and export price policy, relations with other Soviet companies, and currency expenditures abroad.

Finally, Daniel Guyot recommends a close study of the fiscal aspects of the future joint ventures: France and the USSR concluded an agreement to avoid double taxation in October 1985.

[Box 2, p 69]

The 20 French Candidates

Some 20 French companies are interested in setting up joint ventures in the USSR. According to the trade attache of the USSR in France, they are: Thomson-CSF, Rhone-Poulenc, Pechiney, CDF-Chimie, SAGEM, CGE-Alcatel, SPIE-Batignolles, Valeo, Lectra Systemes, Vestra-Union, Interagra, Sciaky, Escoffier, Pernod Ricard, Celatose....

No agreements have been signed thus far. Elsewhere in the West, some 100 projects are being studied. Some memorandums of understanding have been announced. They involve:

--The Italian Fata (project to set up industrial refrigeration in conjunction with a state consortium at Volzhsk):

--The German firms Salamander, the leading shoe manufacturer, and Burda (for publication of a women's magazine in conjunction with the State Committee for Publishing);

--The Finnish airline company, Finnair, and a Soviet partner will renovate the Berlin Hotel in Moscow.

Some projects are American such as those submitted by Occidental Petroleum (chemical products), Monsanto (herbicides), and Singer (sewing machines). The American business community has openly expressed "cautious interest" and underlined the existing COCOM restraints for exporting advanced materials and technologies to the USSR.

FRG VERFASSUNGSSCHUTZ REPORT ON EAST BLOC ESPIONAGE

Defense Industry, Microelectronics Targeted

Duesseldorf HANDELSBLATT in German 20 May 87 p 4

[Text] Bonn, 19 May--The East Bloc states continue to focus their intelligence agency activities on acquiring technical know-how illegally from Western industrial states. Through espionage in the area of economics and science, the national economies of the Warsaw Pact countries save a great deal of money each year in development costs. These conclusions emerge from the report by the Verfassungsschutz [Federal Office for Protection of the Constitution] for 1986, which was released Tuesday.

Despite ongoing espionage by Eastern intelligence agencies and despite an increase in the use of violence by leftist extremists and further violence by rightist extremists, about which the Verfassungsschutz also provides information, Federal Minister of the Interior Friedrich Zimmermann concluded: "Enemies of the constitution have no chance here; democracy is safeguarded."

In the area of economic and scientific espionage, the interest of the Eastern intelligence agencies is focused on the overall domain of industrial research and production. Special status in this continues to be enjoyed by microelectronics.

Reconnaissance Starts at Small Companies

The East Bloc intelligence agencies continue to expend a great deal of effort on trying to get information and products in the general area of the arms industry. They frequently initiate their attempts at small companies or with individuals where the effects of financial incentives are particularly promising, or where economic dire straits are not infrequently exploited.

According to the findings made public by officials of the Verfassungsschutz, the Ministry for State Security in East Berlin has for a number of years also shown interest in know-how emerging from the FRG construction industry. By illegally acquiring information and products from this branch of industry, the GDR avoids the significantly higher costs associated with regular purchases and is thus able to stimulate the efficiency and competitiveness of its construction industry at a very low cost.

According to the Verfassungsschutz, one important potential source of information for the Eastern intelligence agencies is scientific and technical studies, even if they are not subject to any degree of formal secrecy.

Market Research and Product Data

In this sense, according to observations by counterintelligence authorities, there is special interest in publications by publishing houses that are engaged in market research and publish a broad range of product data with detailed descriptions. Although such documents are easy to come by, their sales are generally limited to Western countries. The East Bloc thus uses its intelligence agencies to acquire them. Information on plans and products in the arms industry, especially in the aerospace field, are particularly valuable here. In the judgement of the Verfassungsschutz, careful evaluation of them gives the other side an overview of a broad commercial spectrum and makes it possible for them to narrow down their objectives for espionage assignments.

The so-called mixed companies have proven to be of growing interest for espionage; these are companies in which German partners and East European state-owned companies have a majority interest and at which numerous citizens of communist-ruled countries are employed. According to the information determined by the Verfassungsschutz, these "mixed companies" are able to use their activities as a good cover-up for the illegal acquisition of scientific and technical information and of goods that are subject to embargo restrictions.

Recruitment, Espionage Methods

Duesseldorf HANDELSBLATT in German 26 May 87 p 3

[Text] Duesseldorf, 25 May--Trade fair visits, business relations with firms from East Bloc countries, but also to an increasing extent visits by relatives are the means for initiating contacts preferred by the intelligence agencies of East Bloc countries, according to the Federal Ministry of the Interior in a report on problems of economic espionage included in the May issue of INFORMATIONEN ZUR INNEREN SICHERHEIT.

The Verfassungsschutz report for 1986 also contains a detailed report on economic espionage engaged in by East Bloc intelligence agencies (see HANDELSBLATT of 20 May 1987). In the experience of the Verfassungsschutz, counterintelligence work, which is complicated as it is, faces particular difficulties in combatting economic espionage. The Verfassungsschutz complains of a certain hesitancy in giving counterintelligence authorities details on reconnaissance attempts by enemy intelligence agencies or in revealing an already existing intelligence connection. This makes it more difficult to uncover cases of espionage early on, which is clearly in the interest of the company involved, the agency says.

Data Are Gathered Meticulously

It is also true that recruitment attempts and assignments by enemy intelligence agencies are often not recognized initially. The type and amount of payment for the "service" rendered, in general a clear indication that an intelligence service is involved, is supposedly misunderstood as a "hidden provision," particularly in illegal technology transfer.

Eastern economic espionage is targeted towards the arms industry in particular. Because of linkage and the technical interdependence of the various branches, however, the broad spectrum of interests of Eastern intelligence agencies comes to include nearly the entire realm of industrial research and production. The intelligence agencies have their sights set on microelectronics in particular, with its various fields of application.

The Verfassungsschutz provides as an example this everyday but typical attempt at contact: During a visit to the GDR, an employee of a German computer manufacturer gave a childhood friend, who is similarly involved in data processing in that country, a package of computer paper. The East German used the paper in his enterprise, which the Ministry for State Security eventually found out about. During his next visit to the GDR, the West German was approached by two members of the State Security Service. They made reference to his "friendly service" and then asked that he supply certain microelectronic components.

According to the Verfassungsschutz, West Germans who come into contact with a GDR intelligence agency are always surprised at how directly they are approached and at the thoroughness of personal information that the other side demonstrates after only a short time. In the area of economic espionage, this is supposedly true not only of one's personal life, but also of the company with which the person in question is employed. The Verfassungsschutz explains this as being a result of the meticulousness with which the intelligence agencies in the East Bloc gather data on all interesting companies and the people employed there.

Lucrative Deals as Bait

In the past, the initiation of contacts with business people from the FRG was done within the framework of business connections or during visits to the Leipzig fair. The East Bloc state monopoly on foreign trade offered ideal circumstances for this, the Verfassungsschutz report states. There are employees of the intelligence agencies at work in the Ministry for Foreign Trade and in the foreign trade enterprises who examine contacts to Western firms for their usefulness to the intelligence services.

From time to time, they have themselves intervened in trade negotiations at an early stage. The immediate goal is to lure Western business people with the prospect of lucrative import or export deals. If such interest is aroused, then the business partner is reportedly asked to prove his willingness to deliver by providing documents that cannot be legally sent to the East Bloc. Currently, there is a preference for attempts at contact during private trips, either visits to relatives or sightseeing trips. It is not unusual for a

contact person to show up at the relatives' house several days before the visitor's arrival, giving some pretext for wishing to speak to the guest and generally making an appointment on the spot.

In other cases, the relatives or hosts are themselves unofficial employees of the Ministry for State Security and are involved in the effort. In one recent case, for example, the department head of an international electronics company was asked by his stepbrother in the GDR to obtain information on a process control method. If successful, the stepbrother was to receive from the Ministry for State Security financial rewards and a medal.

Money Is the Most Important Means of Recruitment

The most important means of recruitment is money. Compared to other areas of espionage, relative high amounts of money are involved at a very early stage. On occasion, offers of money are linked to comments to the effect that refusal could lead to a significant disruption of existing commercial relations to the East Bloc. However, this usually does not take place. Nevertheless, a businessman who realizes a large part of his sales in trade with the East could be faced with a critical situation, the report notes.

In contrast, the intelligence agencies of the USSR obtain high technology in part using classical intelligence resources and methods. Technology transfer as managed by the intelligence services is often initiated by members of the KGB or GRU--thus, by members of the Soviet intelligence services--through approaching target persons at their company's exhibit during trade fairs in the FRG and then asking them harmless questions on the range of products offered. In the experience of the Verfassungsschutz, the Soviets in this way convey the impression that they are normal trade representatives and potential buyers. The preferred targets to be approached are people from small, often financially weak or newly-established firms.

12271
CSO: 3698/467

BRIEFS

BULGARIAN COMPUTER TRADE--All data processing exports and imports go through ISO Timpex in Sofia. Established in 1986, this international trade organization linked to the Ministry of Engineering and Electronics is one of the largest Bulgarian companies. The annual sales volume of exported products reaches $1 billion. From 1970 through 1978 the company's exports increased 23 times and growth has continued since at an annual rate of 10 percent. ISO Timpex has contacts with some 60 countries. It has even entered into joint venture agreements with companies in some countries: Italy, Yugoslavia, Japan, the FRG, and France. In France business is done through Sofbim (Paris-Argenteuil, 3, boulevard des Martyrs de Chateaubri). Most exports go to the USSR, the GDR, Hungary, Poland, Czechoslovakia, and Cuba, largely because of exchanges of hardware--especially of peripherals--among CEMA member countries. [Excerpt] [Paris ZERO UN INFORMATIQUE in French 2 Mar 87 p 28] 25055/9190

CSO: 3698/A180

HUNGARIAN, SOVIET PHYSICS INSTITUTES TO COLLABORATE FORMALLY

Budapest MAGYAR NEMZET in Hungarian 25 Apr 87 p 10

[Interview with Ivan Kertesz, department head of the Central Research Physics Institute, by Mrs Pal Vitanyi and Istvan Molnar: "Joint Soviet-Hungarian Research--The Physics of the Next Century"]

[Excerpt] As reported in the papers, a contract signed 16 April governs the future joint activities of two scientific institutions: the Central Research Physics Institute [KFKI] and the Institute of General Physics [IGP], an adjunct to the Soviet Academy. Ivan Kertesz, a department head at the KFKI participated in the preparation of the document. We sought information from Kertesz concerning the antecedents, and in particular about the expectations they have pinned to this unusual agreement. Because the adjective "unusual" is justified indeed--the agreement provides for the establishment of a joint research group headquartered in Budapest, with a permanent staff that includes the scientific experts of the Moscow institution.

Headquarters: Budapest

[Answer] This is a new chapter in the continuous cooperation of a quarter of a century. One must summarize the antecedents, if only in a few sentences, in order to be able to respond to the question itself: what do we expect from this contract? The nearly 25 years old relationship was based on an agreement between the academies of the two countries. In the framework of that agreement there emerged opportunities to take note of basic research accomplishments within the IGP, but from the viewpoint of scientific transfer, joint work progressed with difficulty. It is also true that there were some significant results. I must tell you this: Soviet scientific institutions function in a completely different economic environment than ours do. First of all they need not sustain themselves, to use this bureaucratic term. Marvelous ideas come into being virtually on a production line--new materials, new processes, then follows scientific publication, and that usually ends the list of tasks. We, on the other hand, were forced to discover in these ideas and in other achievements the aspect of possible utilization. By logic, all this suggests that strategy, if you will, is the essence of past and future cooperation. I can say this because we have tested it. In Moscow they developed phosphate glass with high neodymium concentration. We built a low capacity laser with record parameters. And we were able to think and work

together very efficiently. When we asked our partners to produce this material in a few different variations, the test samples were finished within two months--a time period that constitutes a world record in this field. And this also suggests that it makes a difference to a professional engaged in basic research whether the result of his idea is a tangible product. In the end it was this international success that provided the impetus to try to separate this kind of cooperation from the academic framework, and to transform cooperation into a kind of joint work which can produce similar or even more valuable results.

[Question] How many of you will work in the research group that is being formed at present? And under what system?

[Answer] The headquarters are in Budapest. A few Soviet researchers will work with us. And then, of course we will pay mutual visits more frequently. The way we see it, we will use every opportunity to consult broader circles. The core--I would think--may be composed of 20 persons. Although it is possible that I am mistaken in this respect. The Ministry of Industry also became a party to the contract--and this is a brand new development. But the number of individuals is not important. Far more important is the new form, the new framework which provides flexible opportunities for new creations. Right now we are taking a deep breath, then we start out--at this time together--to jointly develop high capacity lasers. Robotics is awaiting this kind of equipment with open arms--every new solution has, and will have a good market both in the East and the West.

More or less, that's what it's all about: market. A kind of research success that brings in some money too, over and above recognition. And the contract between the two institutions improves our common chances--quite substantially, if our hopes are fulfilled.

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CSO: 2502/64

HIGH-VELOCITY MISSILE BEING DEVELOPED FOR ARMY

PY012227 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 31 May 87 p 2

[By Roberto Godoy]

[Text] The first high-velocity missile manufactured by the Brazilian war industry will be operational in 1988. This is the sophisticated MSAAV (Land-to-Air High Velocity Missile) jointly developed by ENGESA [Specialized Engineers, Inc] ORBITA [expansion unknown] and the British Aerospace group to meet the Brazilian Army's specifications. It is a remarkable weapon that can be fired from the shoulder at a target within a 5-7 km radius, flying at four times the speed of sound (nearly 5,000 kph). [paragraph continues]

The explosive charge of the warhead is small since the enemy aircraft will be destroyed by the transfer of kinetic energy upon impact of the extra-hard, high-speed warhead into the fuselage.

According to British Aerospace spokesman Ian Ostling, "in recent years the company has accumulated considerable expertise in this field and has great interest in applying it to new undertakings." Ostling said for at least 5 years his company has maintained a program "exclusively related to high-velocity devices."

The ENGESA-ORBITA group, formed this past January with the participation of EMBRAER [Brazilian Aeronautics Enterprise], is already developing the Leo project for the Army. This will be an antitank, laser-guided missile based on Italian technology from the Oto-Melara Company. The group has also assumed control of the old Piranha project, now renamed the MAA-1 Mol project, to provide the Air Force with an infrared, thermal-attracted air-to-air missile.

The MSAAV is simple and very efficient. In a single unit weighing approximately 30 kg, the operator will have all the optical and electronic information to fire at a low-flying aircraft or helicopter, or even at a light armored vehicle -- within a range of 7 km. The guidance system, which is "classified," probably will be based on a carbon dioxide laser, and it will provide information on target distance, target speed, and target priority by the nearest impending danger criterion, all within 1 second.

During the very fast flight to the target, the operator can steer the weapon by reading the real time of the laser's Doppler effect (changes in frequency as the missile gets closer or farther from the target). The MSAAV will weigh approximately 20 kg, carrying a 2.7 kg warhead of hardened metal (tungsten or nonactive [exaurido] uranium). The missile will be 1.2 meters long, with a 70-mm caliber. It will have no mobile parts. It will be stabilized in flight by a gyroscopic sensor and by its high average acceleration of up to 4.5 Mach.

To boost the appeal of the missile on the foreign market, ENGESA-ORBITA intends to make it very easy to operate, only requiring a few hours training for a man to carry out defensive missions under practically any condition.

In the United States, the LTV-VOUGHT Company completed development of its air-to-surface HVM (high-velocity missile) in 1983, and it is now working on a surface-to-air configuration that was tested in March. The training manual prepared by the LTV-VOUGHT Company carries in its first page an indication of the simplicity of the missile's operation: "You see the target, you aim at it, you squeeze the trigger, and then you no longer see the target."

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END

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